FIG. 1

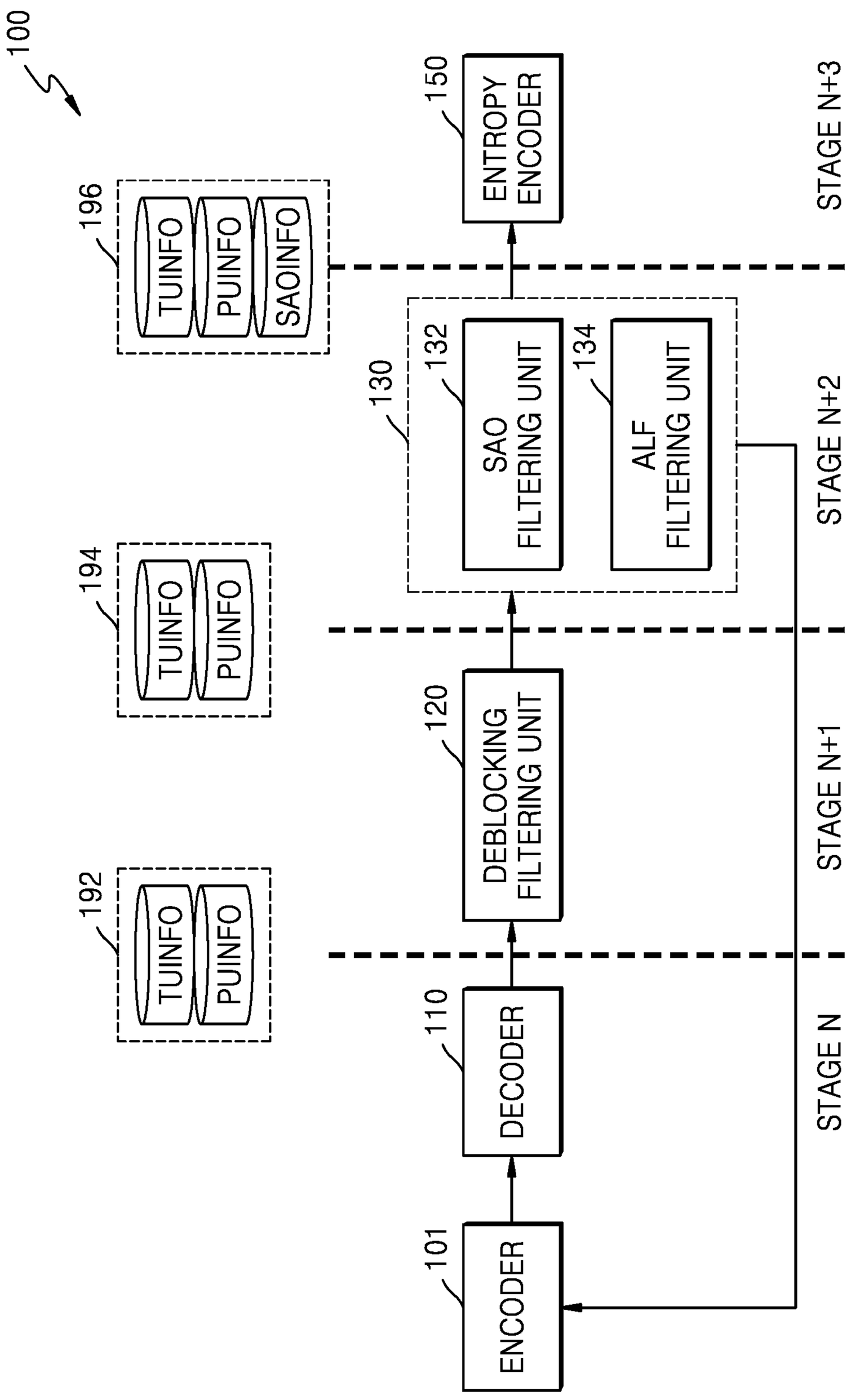

100
196
TUINFO
PUINFO
SAOINFO
150
ENTROPY ENCODER
STAGE N+3
130
132
SAO FILTERING UNIT
134
ALF FILTERING UNIT
STAGE N+2
194
TUINFO
PUINFO
120
DEBLOCKING FILTERING UNIT
STAGE N+1
192
TUINFO
PUINFO
110
DECODER
STAGE N
101
ENCODER

FIG. 2A

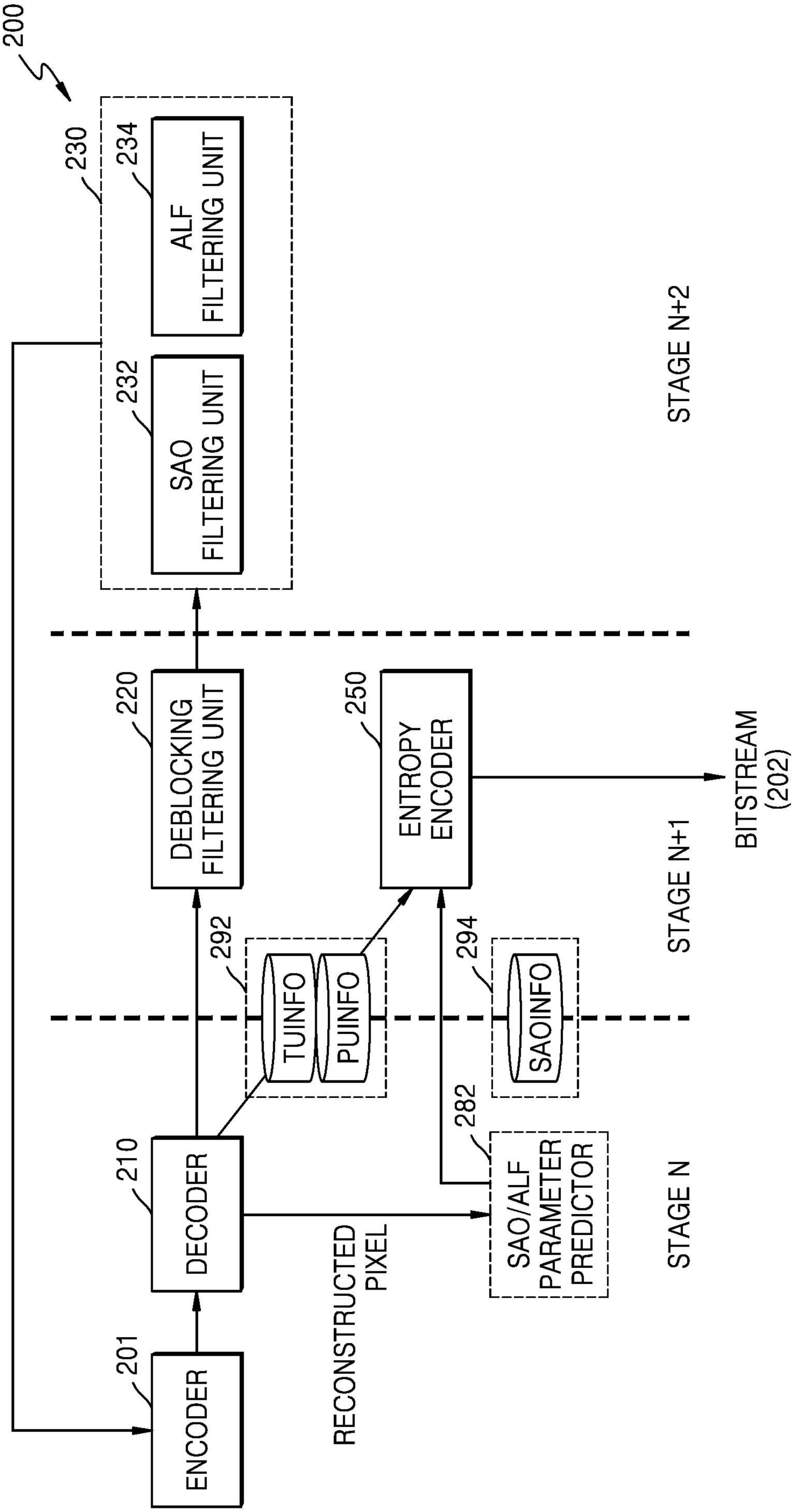

200
230
234
ALF FILTERING UNIT
232
SAO FILTERING UNIT
220
DEBLOCKING FILTERING UNIT
250
ENTROPY ENCODER
BITSTREAM (202)
292
TUINFO
PUINFO
294
SAOINFO
282
SAO/ALF PARAMETER PREDICTOR
210
DECODER
201
ENCODER
RECONSTRUCTED PIXEL
STAGE N-1
STAGE N
STAGE N+1
STAGE N+2

FIG. 2B

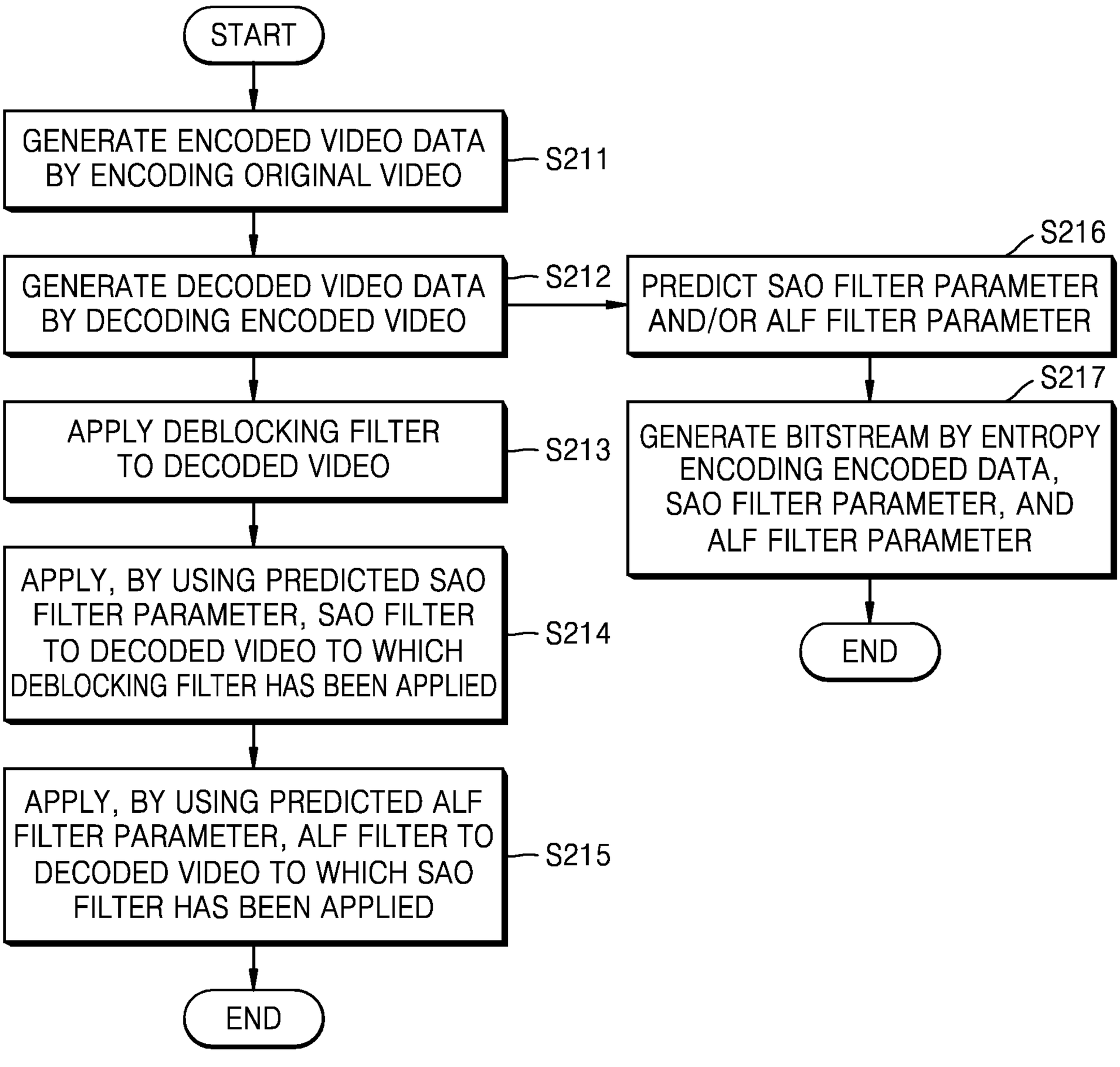

START
GENERATE ENCODED VIDEO DATA BY ENCODING ORIGINAL VIDEO
S211
GENERATE DECODED VIDEO DATA BY DECODING ENCODED VIDEO
S212
APPLY DEBLOCKING FILTER TO DECODED VIDEO
S213
APPLY, BY USING PREDICTED SAO FILTER PARAMETER, SAO FILTER TO DECODED VIDEO TO WHICH DEBLOCKING FILTER HAS BEEN APPLIED
S214
APPLY, BY USING PREDICTED ALF FILTER PARAMETER, ALF FILTER TO DECODED VIDEO TO WHICH SAO FILTER HAS BEEN APPLIED
S215
END
S216
PREDICT SAO FILTER PARAMETER AND/OR ALF FILTER PARAMETER
S217
GENERATE BITSTREAM BY ENTROPY ENCODING ENCODED DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER
END

FIG. 3A

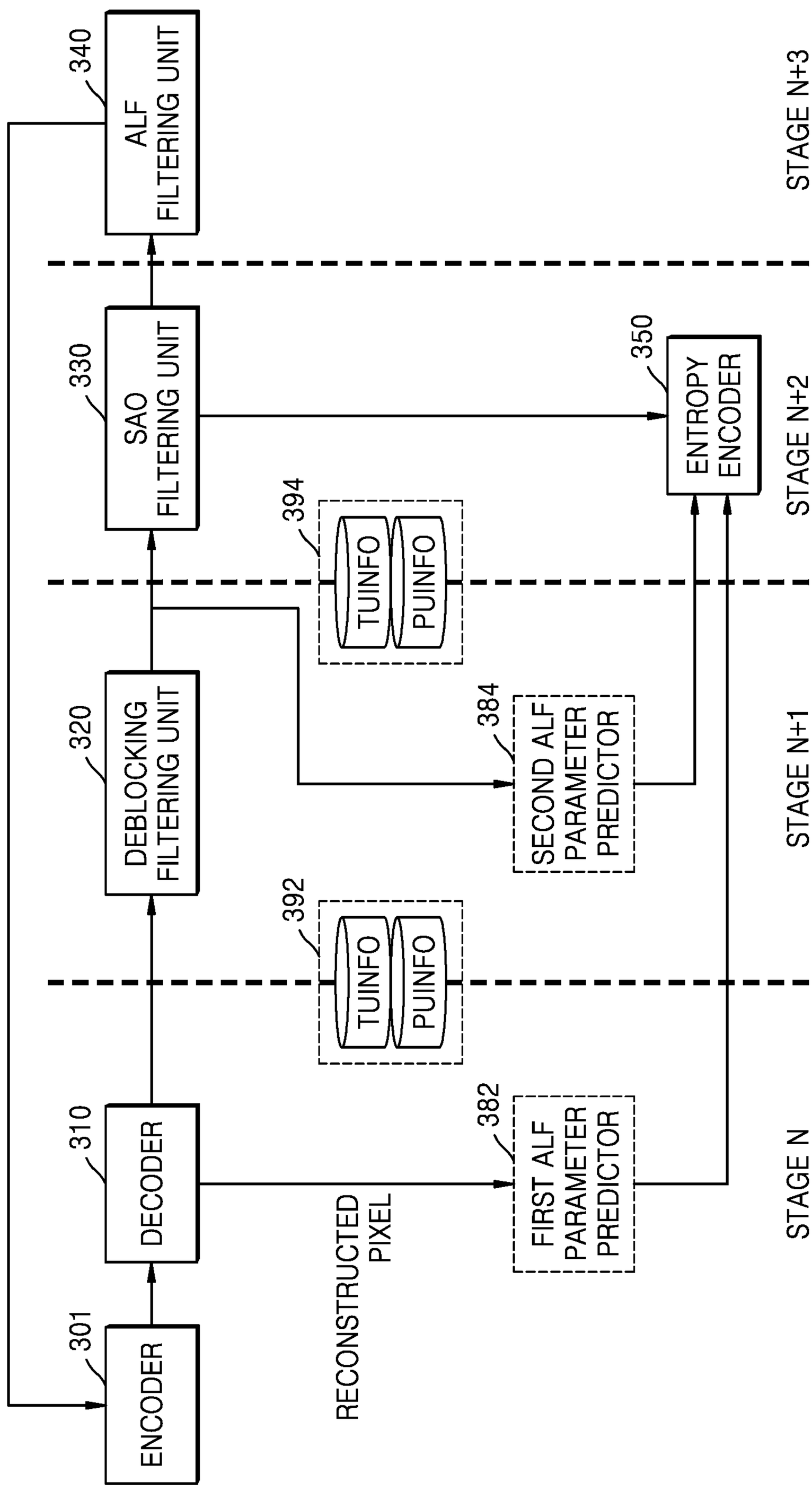

300
340
ALF FILTERING UNIT
330
SAO FILTERING UNIT
320
DEBLOCKING FILTERING UNIT
310
DECODER
301
ENCODER
350
ENTROPY ENCODER
394
TUINFO
PUINFO
392
TUINFO
PUINFO
384
SECOND ALF PARAMETER PREDICTOR
382
FIRST ALF PARAMETER PREDICTOR
RECONSTRUCTED PIXEL
STAGE N+3
STAGE N+2
STAGE N+1
STAGE N

FIG. 3B

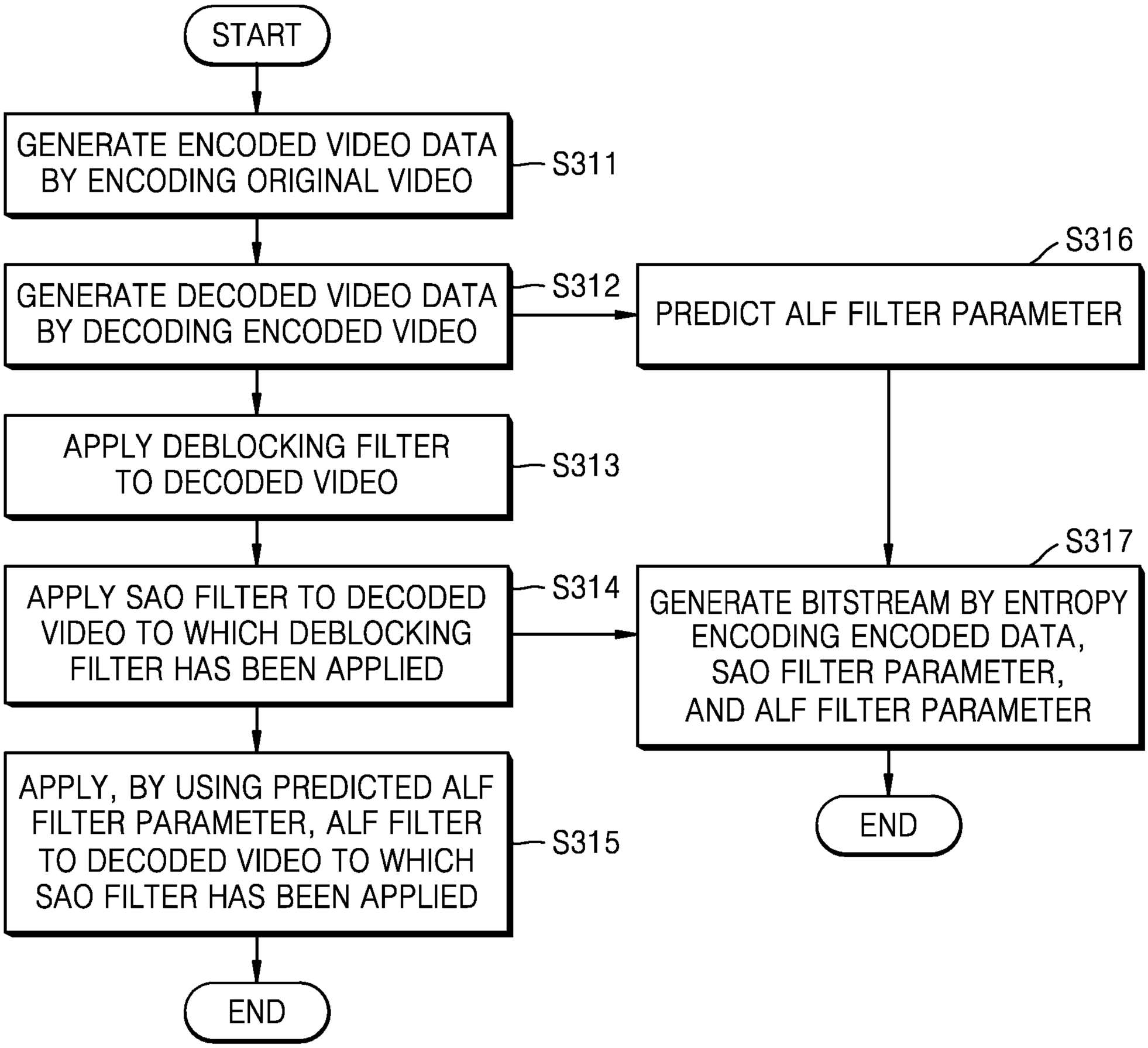

START
GENERATE ENCODED VIDEO DATA BY ENCODING ORIGINAL VIDEO
S311
GENERATE DECODED VIDEO DATA BY DECODING ENCODED VIDEO
S312
APPLY DEBLOCKING FILTER TO DECODED VIDEO
S313
APPLY SAO FILTER TO DECODED VIDEO TO WHICH DEBLOCKING FILTER HAS BEEN APPLIED
S314
APPLY, BY USING PREDICTED ALF FILTER PARAMETER, ALF FILTER TO DECODED VIDEO TO WHICH SAO FILTER HAS BEEN APPLIED
S315
END
S316
PREDICT ALF FILTER PARAMETER
S317
GENERATE BITSTREAM BY ENTROPY ENCODING ENCODED DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER
END

FIG. 3C

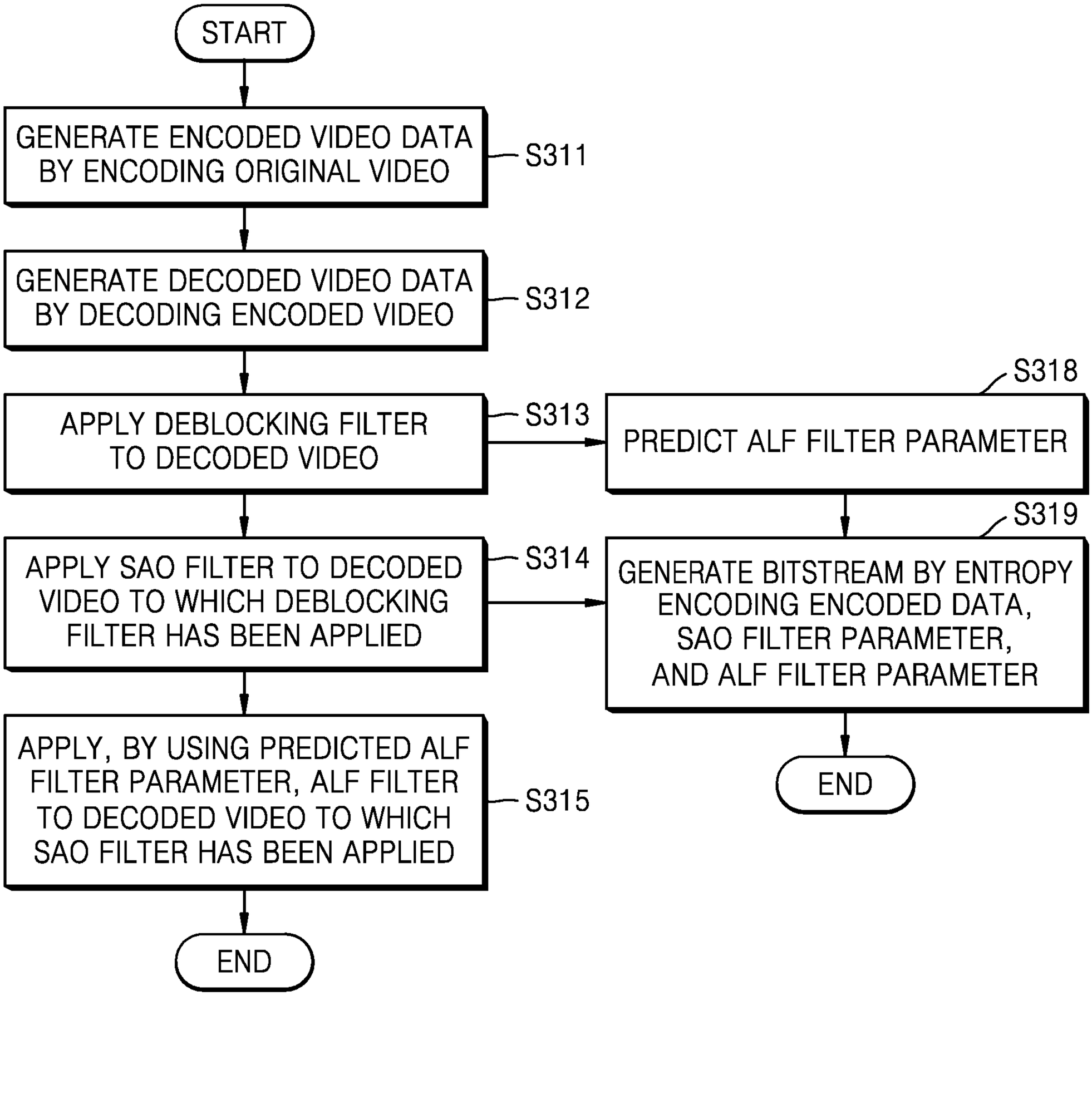

START
GENERATE ENCODED VIDEO DATA BY ENCODING ORIGINAL VIDEO
S311
GENERATE DECODED VIDEO DATA BY DECODING ENCODED VIDEO
S312
APPLY DEBLOCKING FILTER TO DECODED VIDEO
S313
APPLY SAO FILTER TO DECODED VIDEO TO WHICH DEBLOCKING FILTER HAS BEEN APPLIED
S314
APPLY, BY USING PREDICTED ALF FILTER PARAMETER, ALF FILTER TO DECODED VIDEO TO WHICH SAO FILTER HAS BEEN APPLIED
S315
END
S318
PREDICT ALF FILTER PARAMETER
S319
GENERATE BITSTREAM BY ENTROPY ENCODING ENCODED DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER
END

FIG. 4A

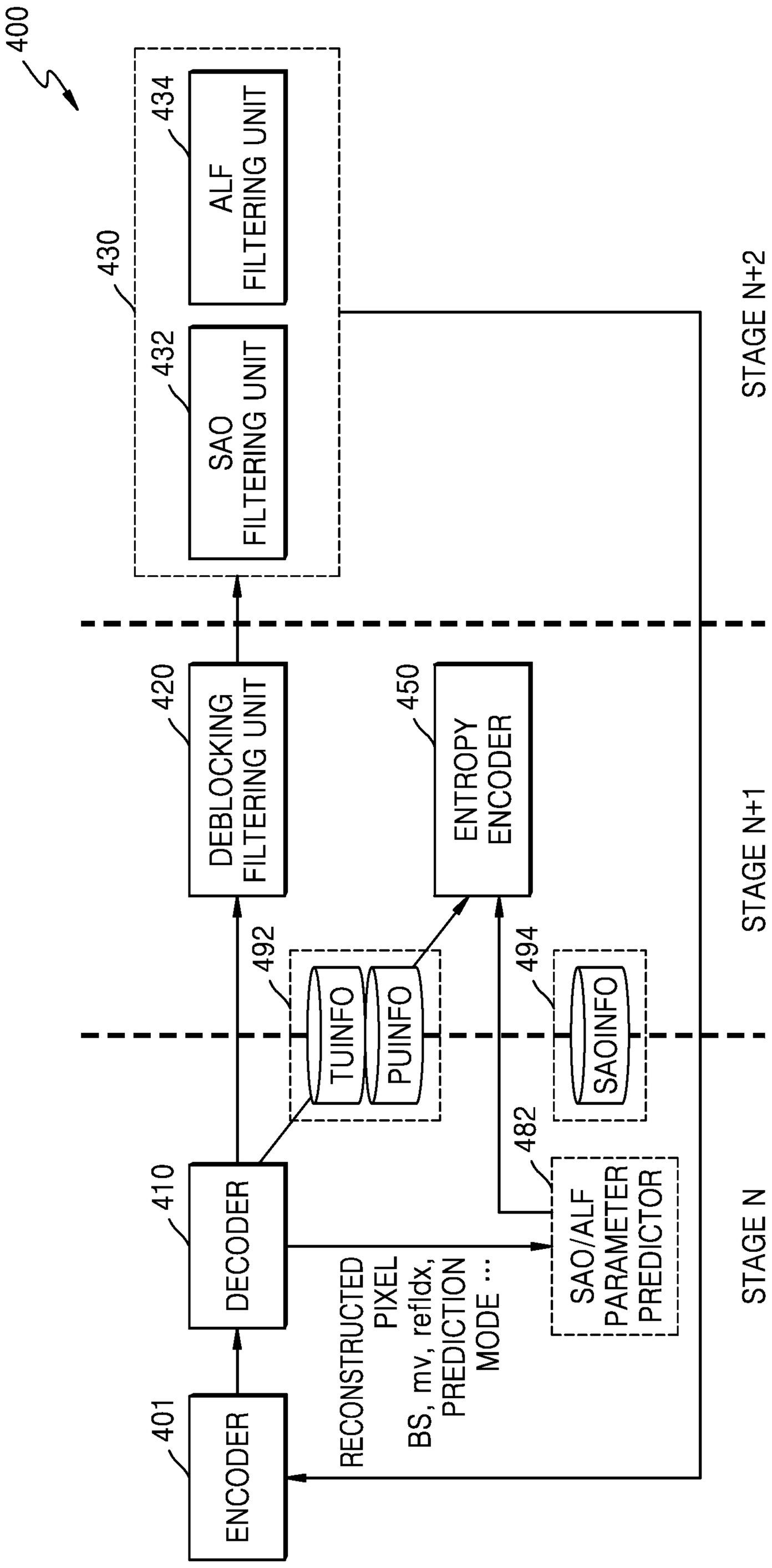

400
401
ENCODER
410
DECODER
420
DEBLOCKING FILTERING UNIT
430
432
SAO FILTERING UNIT
434
ALF FILTERING UNIT
450
ENTROPY ENCODER
482
SAO/ALF PARAMETER PREDICTOR
492
TUINFO
PUINFO
494
SAOINFO
RECONSTRUCTED PIXEL
BS, mv, refIdx, PREDICTION MODE ...
STAGE N
STAGE N+1
STAGE N+2

FIG. 4B

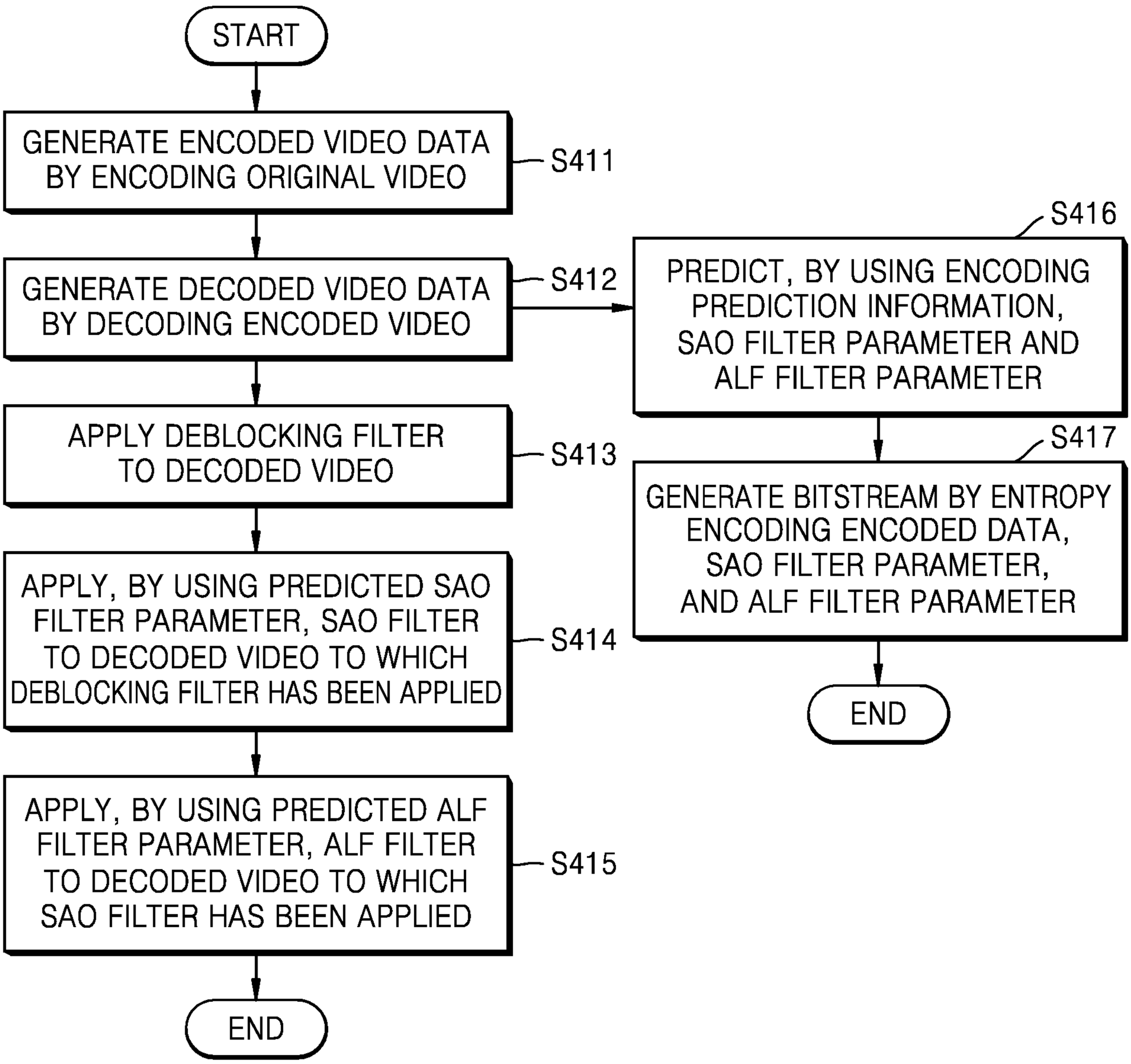

START
GENERATE ENCODED VIDEO DATA BY ENCODING ORIGINAL VIDEO
S411
GENERATE DECODED VIDEO DATA BY DECODING ENCODED VIDEO
S412
APPLY DEBLOCKING FILTER TO DECODED VIDEO
S413
APPLY, BY USING PREDICTED SAO FILTER PARAMETER, SAO FILTER TO DECODED VIDEO TO WHICH DEBLOCKING FILTER HAS BEEN APPLIED
S414
APPLY, BY USING PREDICTED ALF FILTER PARAMETER, ALF FILTER TO DECODED VIDEO TO WHICH SAO FILTER HAS BEEN APPLIED
S415
END
S416
PREDICT, BY USING ENCODING PREDICTION INFORMATION, SAO FILTER PARAMETER AND ALF FILTER PARAMETER
S417
GENERATE BITSTREAM BY ENTROPY ENCODING ENCODED DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER
END

FIG. 4C

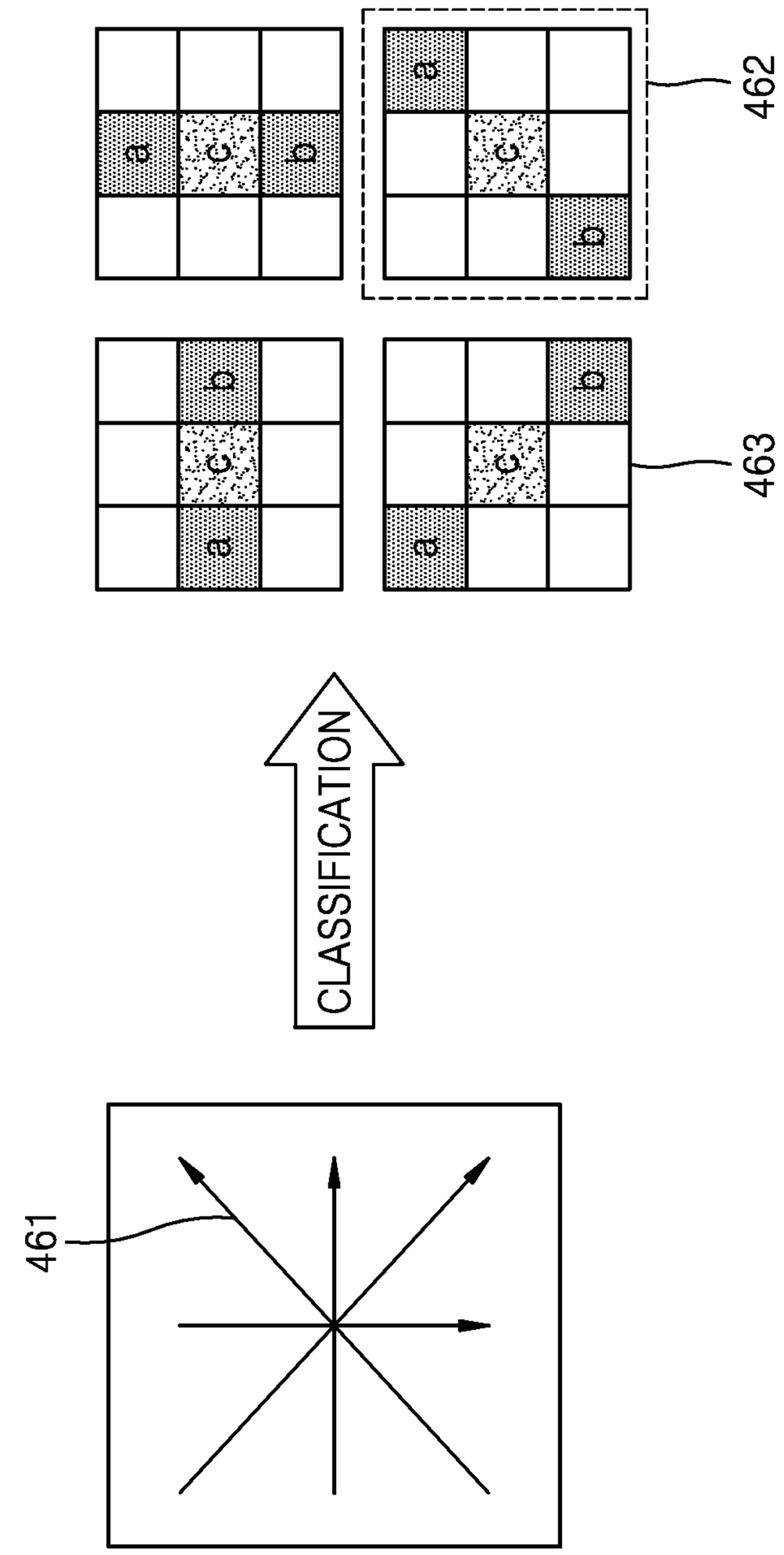
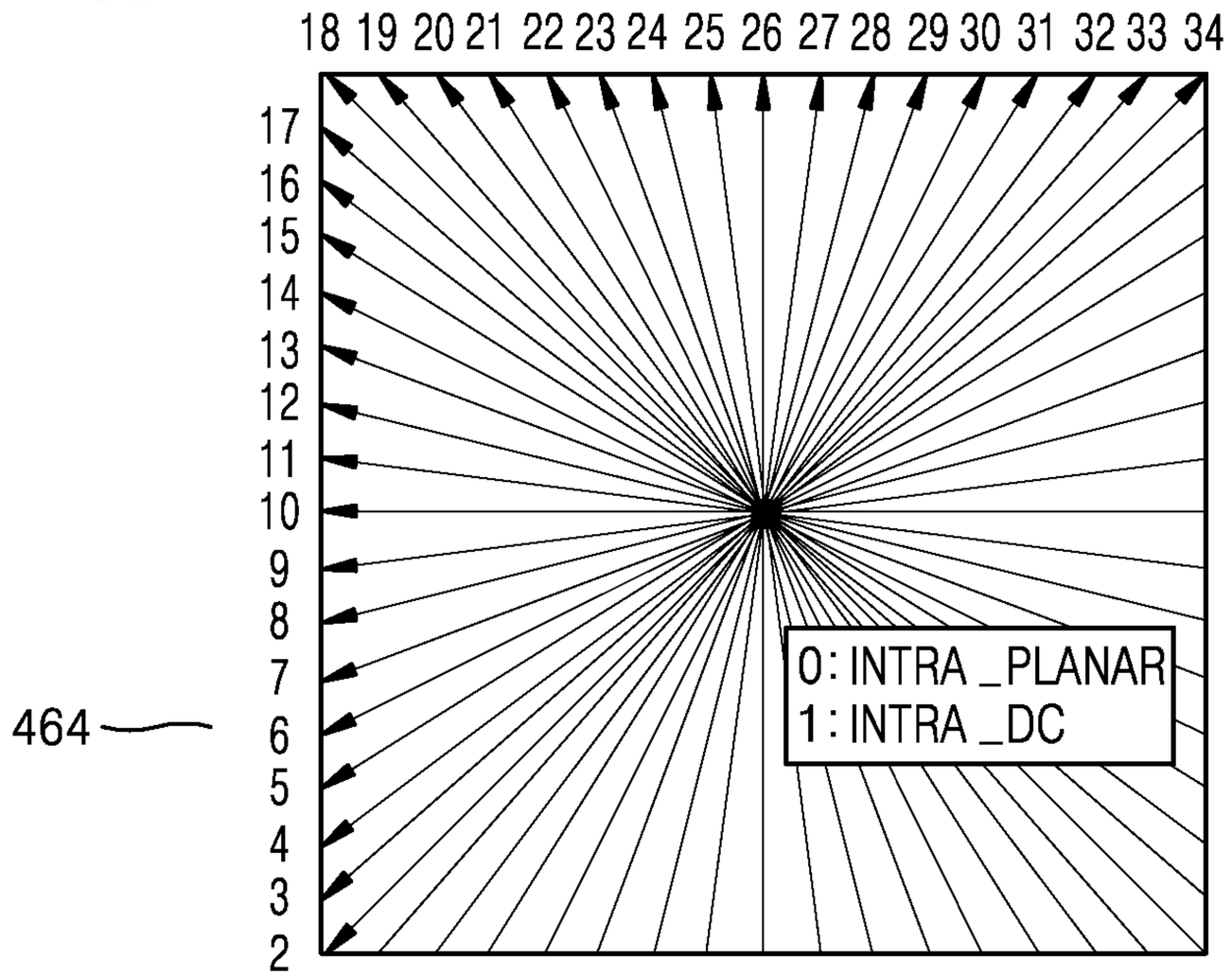


FIG. 4D



464

465

INTRA PREDICTION MODE	DIRECTION CLASSIFICATION
2,3,4,5	45°
6,7,8,9,10,11,12,13,14	Horizontal
15,16,17,18,19,20,21	135°
22,23,24,25,26,27,28,29,30	Vertical
31,32,33,34	45°

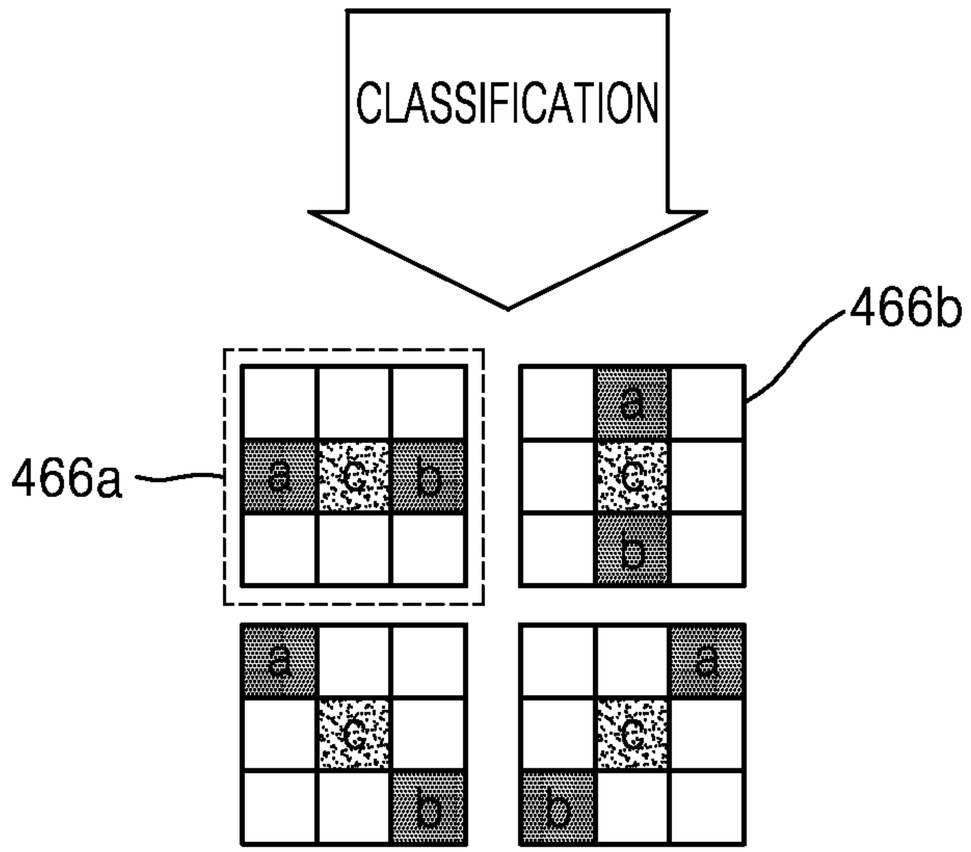


FIG. 4E

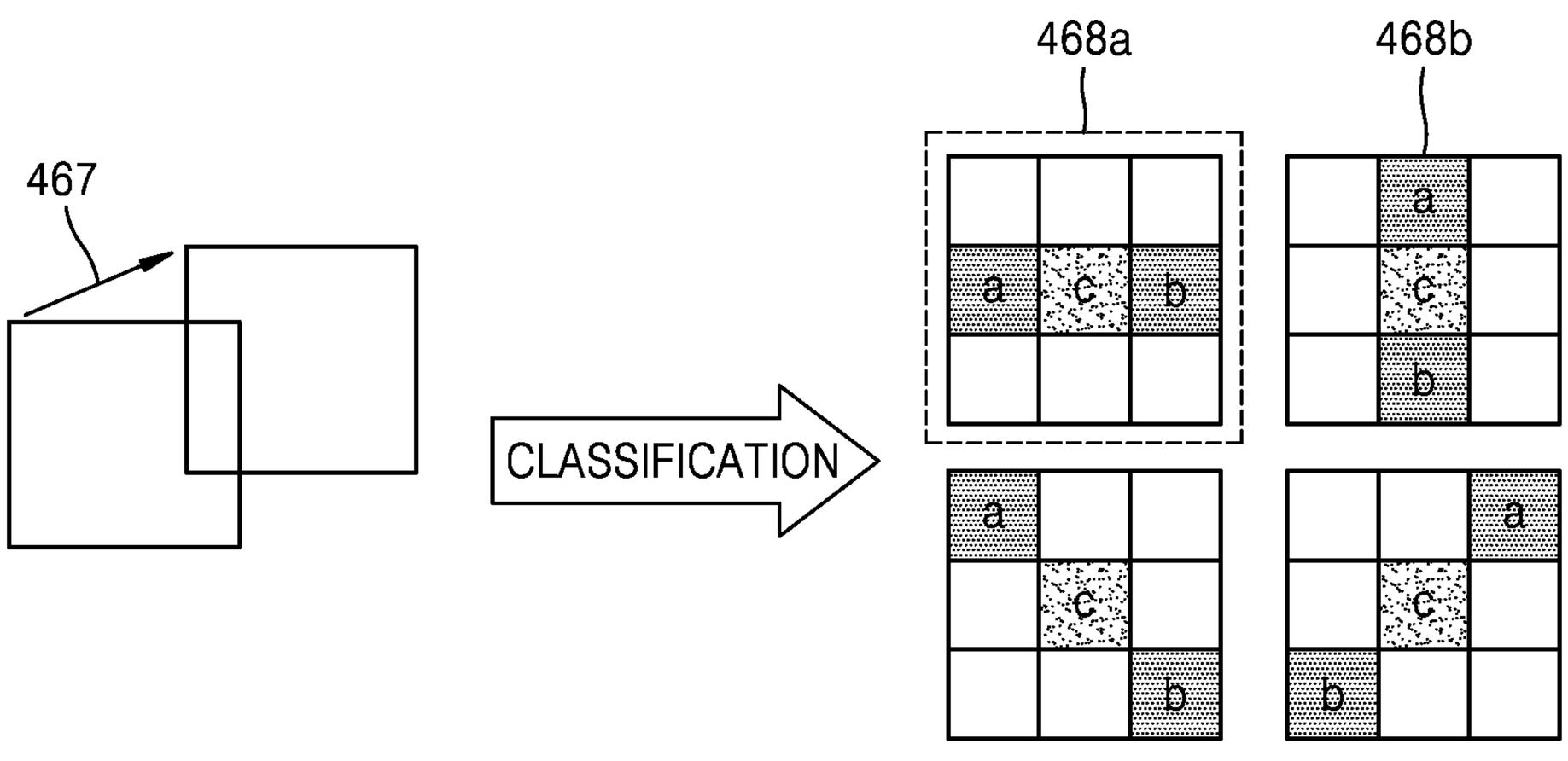


FIG. 5A

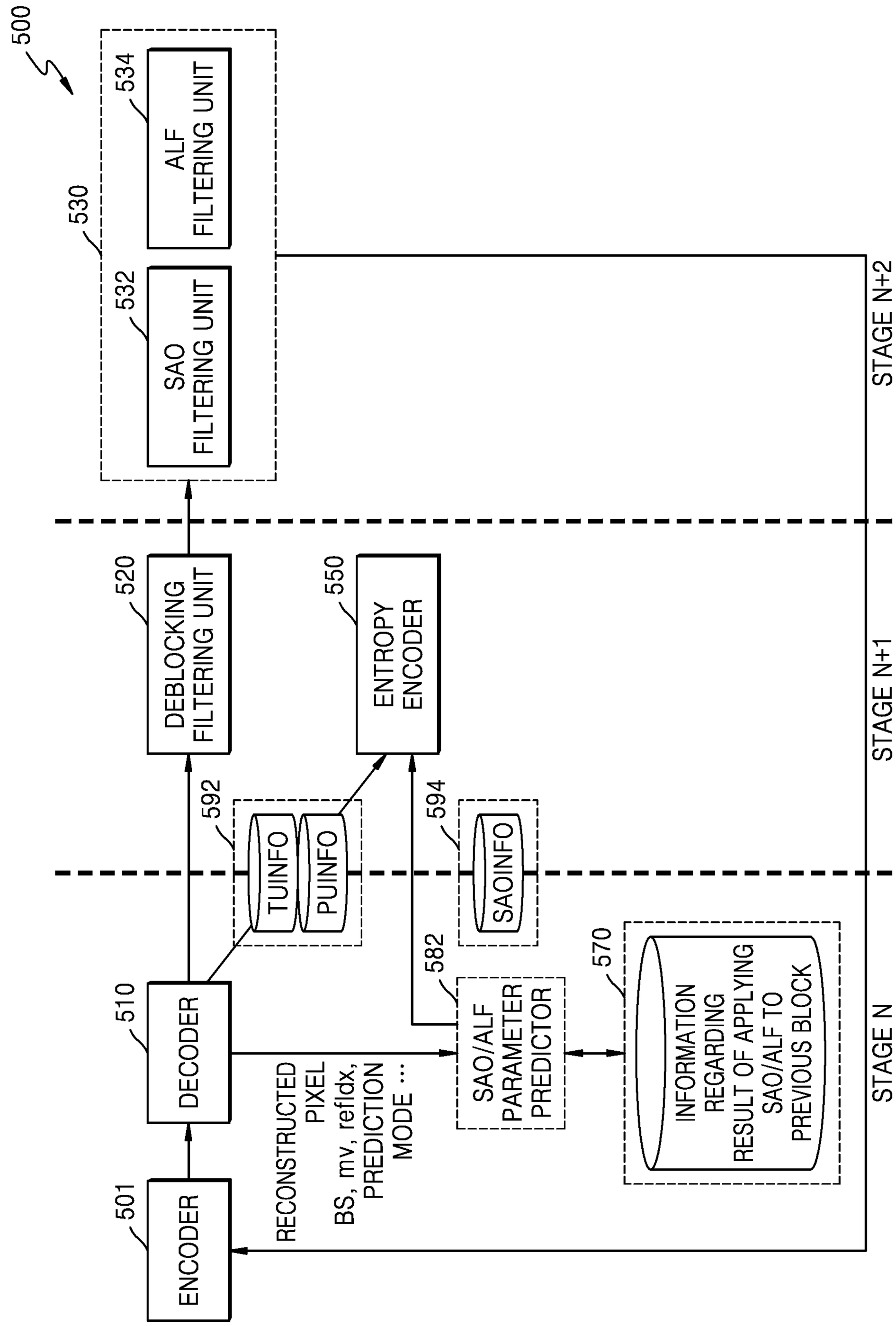

500
534
ALF FILTERING UNIT
530
532
SAO FILTERING UNIT
STAGE N+2
520
DEBLOCKING FILTERING UNIT
550
ENTROPY ENCODER
592
TUINFO
PUINFO
594
SAOINFO
510
DECODER
582
SAO/ALF PARAMETER PREDICTOR
570
INFORMATION REGARDING RESULT OF APPLYING SAO/ALF TO PREVIOUS BLOCK
STAGE N
STAGE N+1
501
ENCODER
RECONSTRUCTED PIXEL
BS, mv, refIdx, PREDICTION MODE ...

FIG. 5B

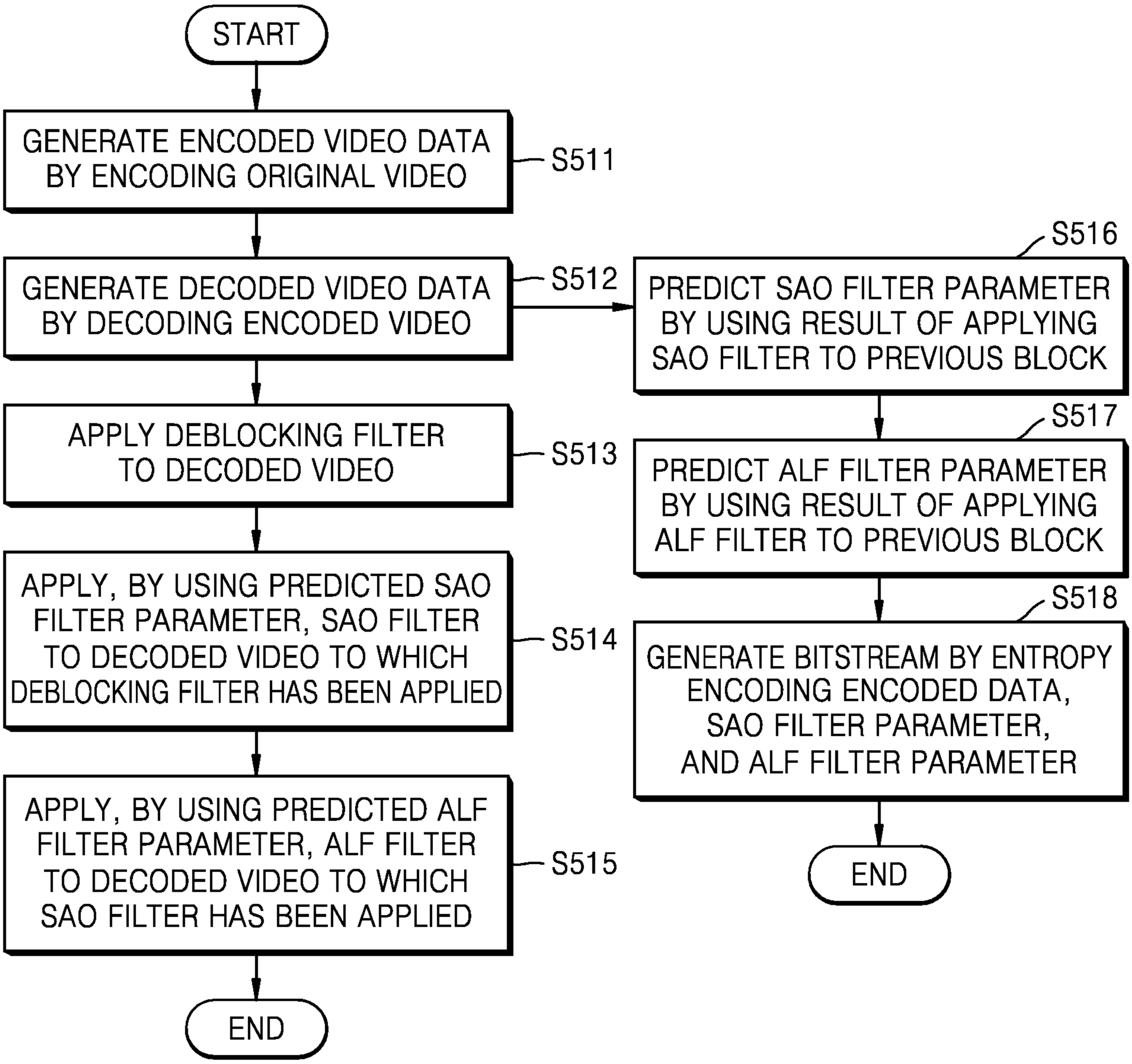

START
GENERATE ENCODED VIDEO DATA BY ENCODING ORIGINAL VIDEO
S511
GENERATE DECODED VIDEO DATA BY DECODING ENCODED VIDEO
S512
APPLY DEBLOCKING FILTER TO DECODED VIDEO
S513
APPLY, BY USING PREDICTED SAO FILTER PARAMETER, SAO FILTER TO DECODED VIDEO TO WHICH DEBLOCKING FILTER HAS BEEN APPLIED
S514
APPLY, BY USING PREDICTED ALF FILTER PARAMETER, ALF FILTER TO DECODED VIDEO TO WHICH SAO FILTER HAS BEEN APPLIED
S515
END
S516
PREDICT SAO FILTER PARAMETER BY USING RESULT OF APPLYING SAO FILTER TO PREVIOUS BLOCK
S517
PREDICT ALF FILTER PARAMETER BY USING RESULT OF APPLYING ALF FILTER TO PREVIOUS BLOCK
S518
GENERATE BITSTREAM BY ENTROPY ENCODING ENCODED DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER
END

FIG. 5C

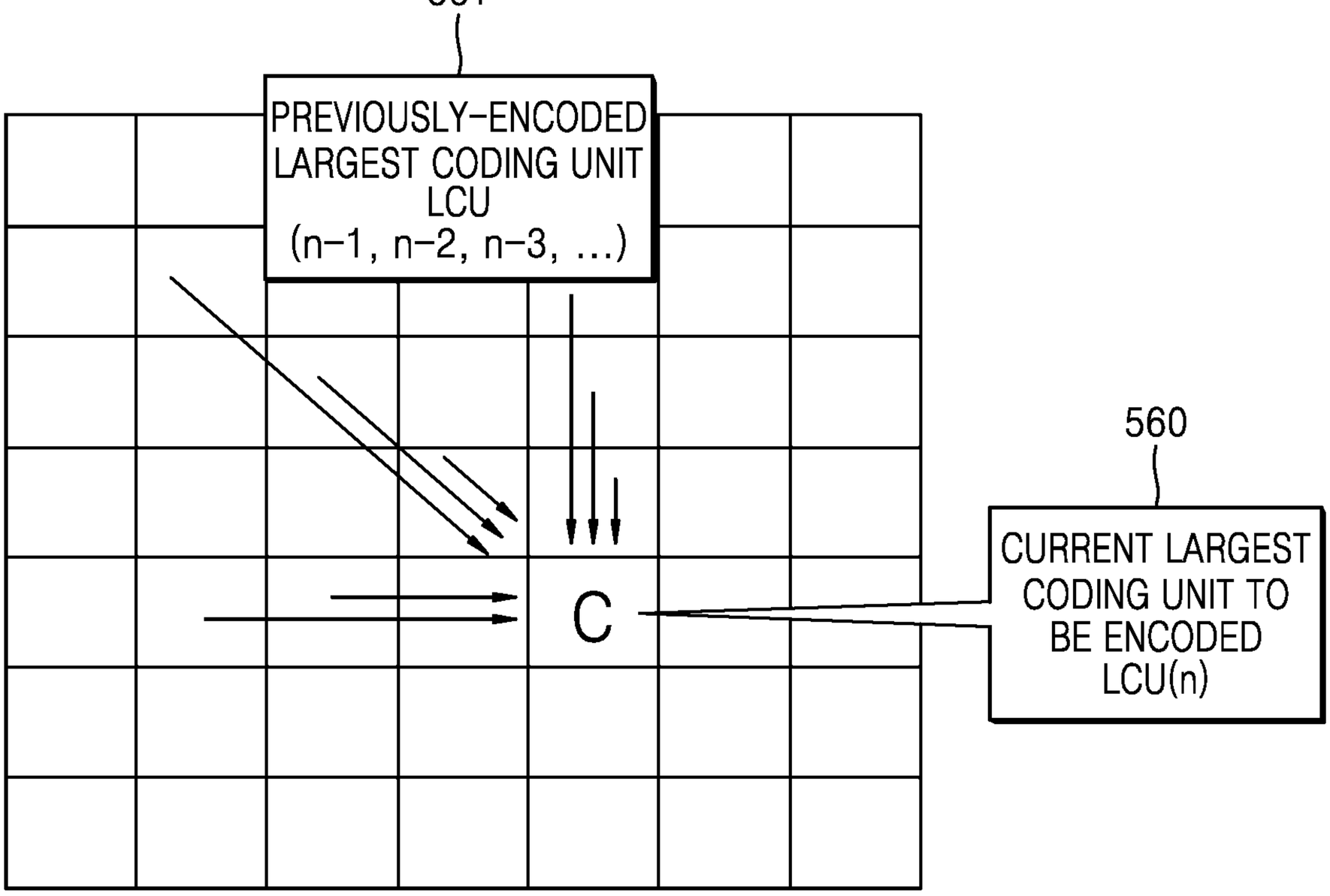

561
PREVIOUSLY-ENCODED LARGEST CODING UNIT LCU (n-1, n-2, n-3, ...)
C
560
CURRENT LARGEST CODING UNIT TO BE ENCODED LCU(n)

FIG. 5D

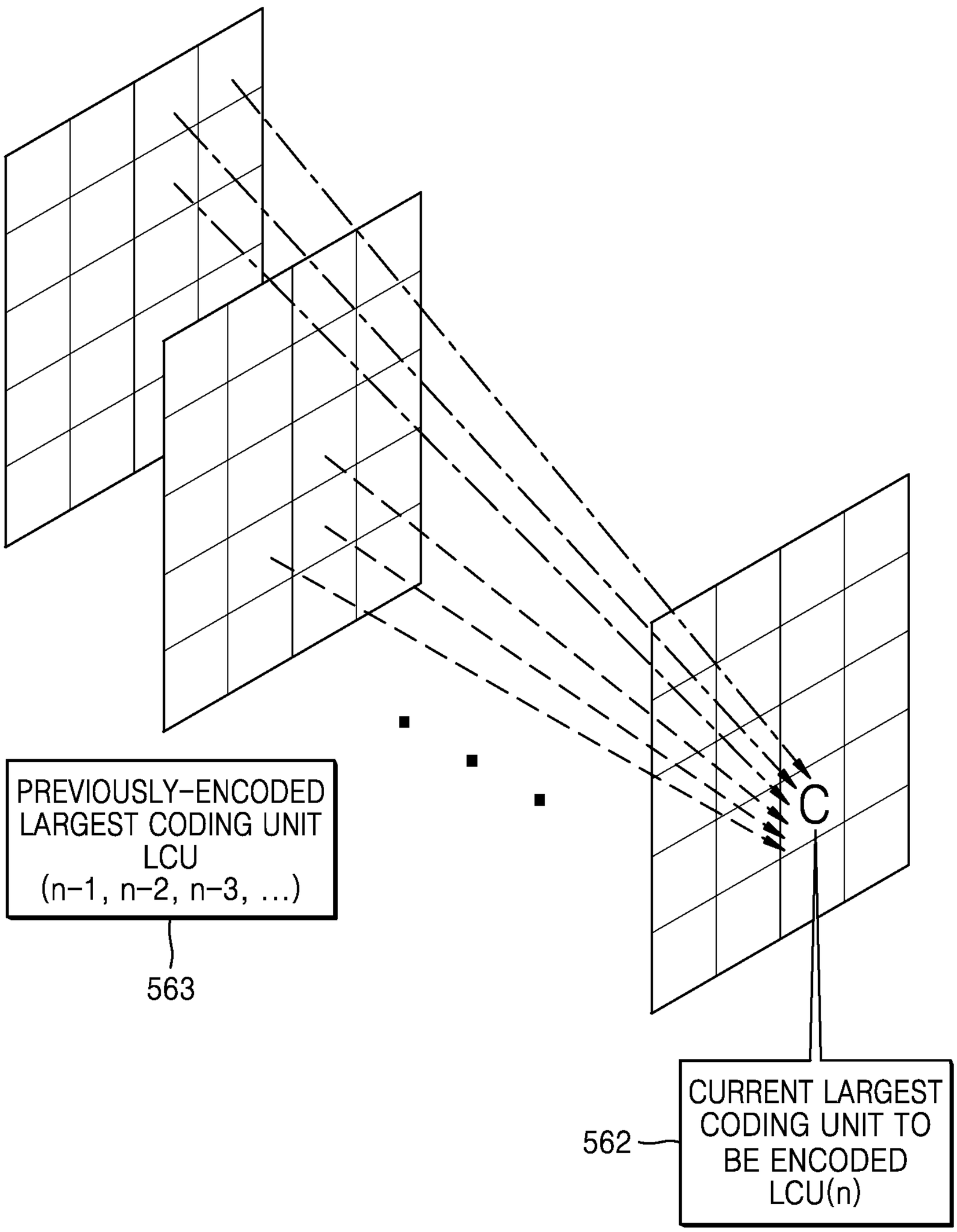

PREVIOUSLY-ENCODED
LARGEST CODING UNIT
LCU
(n-1, n-2, n-3, ...)
563
C
562
CURRENT LARGEST
CODING UNIT TO
BE ENCODED
LCU(n)

FIG. 6A

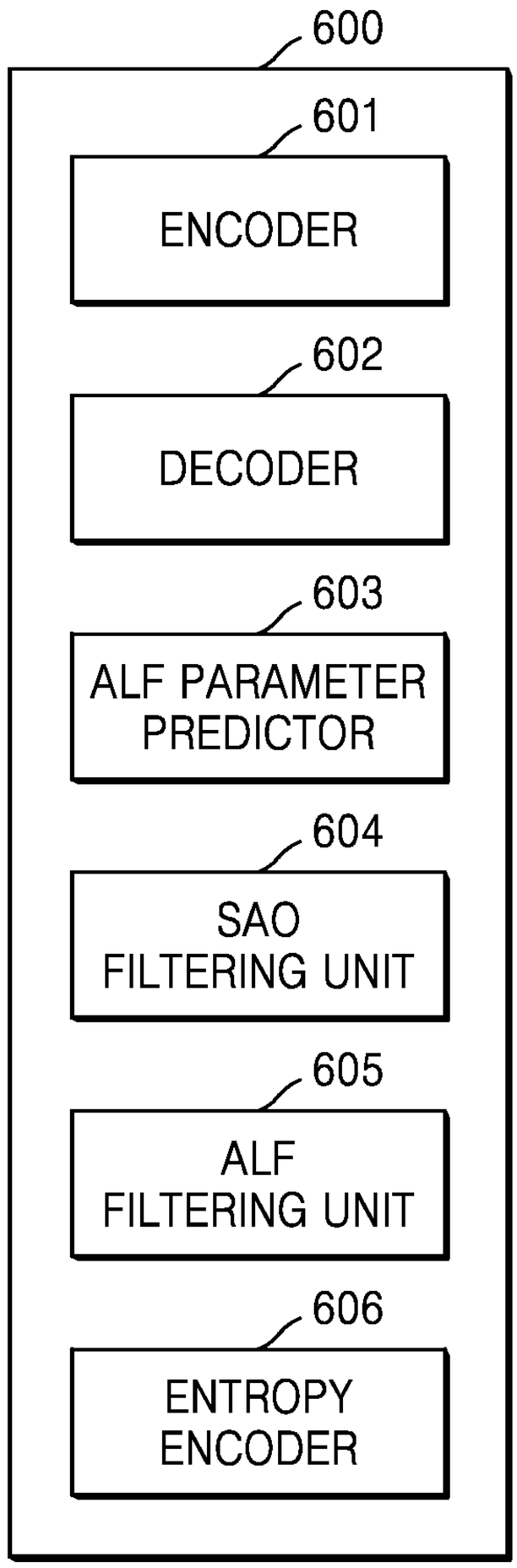

600
601
ENCODER
602
DECODER
603
ALF PARAMETER PREDICTOR
604
SAO FILTERING UNIT
605
ALF FILTERING UNIT
606
ENTROPY ENCODER

FIG. 6B

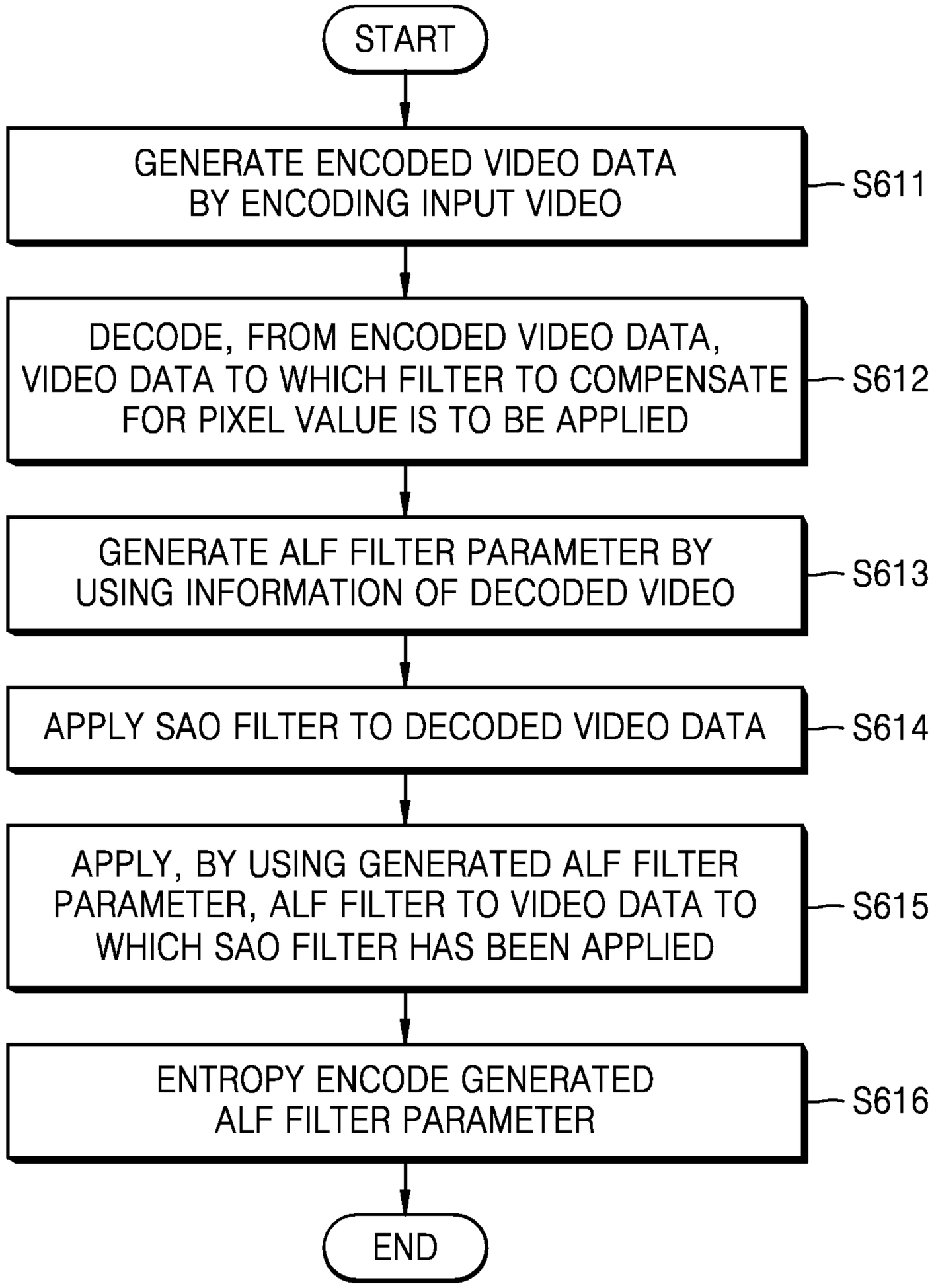

START
GENERATE ENCODED VIDEO DATA BY ENCODING INPUT VIDEO
S611
DECODE, FROM ENCODED VIDEO DATA, VIDEO DATA TO WHICH FILTER TO COMPENSATE FOR PIXEL VALUE IS TO BE APPLIED
S612
GENERATE ALF FILTER PARAMETER BY USING INFORMATION OF DECODED VIDEO
S613
APPLY SAO FILTER TO DECODED VIDEO DATA
S614
APPLY, BY USING GENERATED ALF FILTER PARAMETER, ALF FILTER TO VIDEO DATA TO WHICH SAO FILTER HAS BEEN APPLIED
S615
ENTROPY ENCODE GENERATED ALF FILTER PARAMETER
S616
END

FIG. 7A

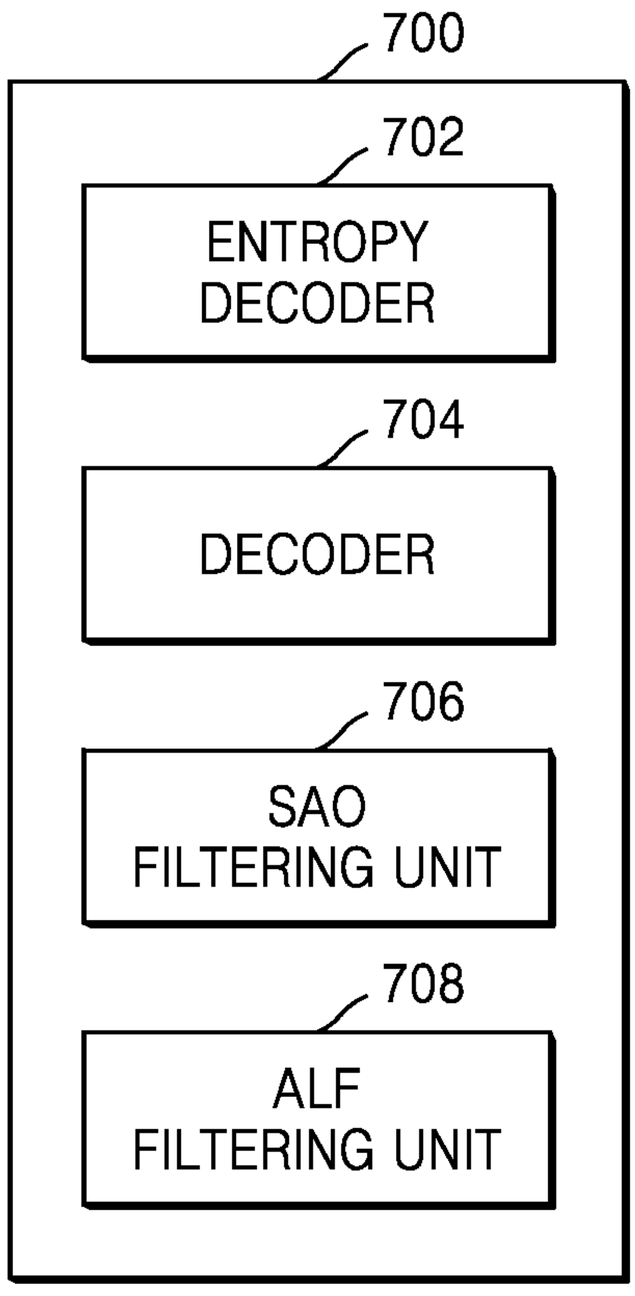

700
702
ENTROPY DECODER
704
DECODER
706
SAO FILTERING UNIT
708
ALF FILTERING UNIT

FIG. 7B

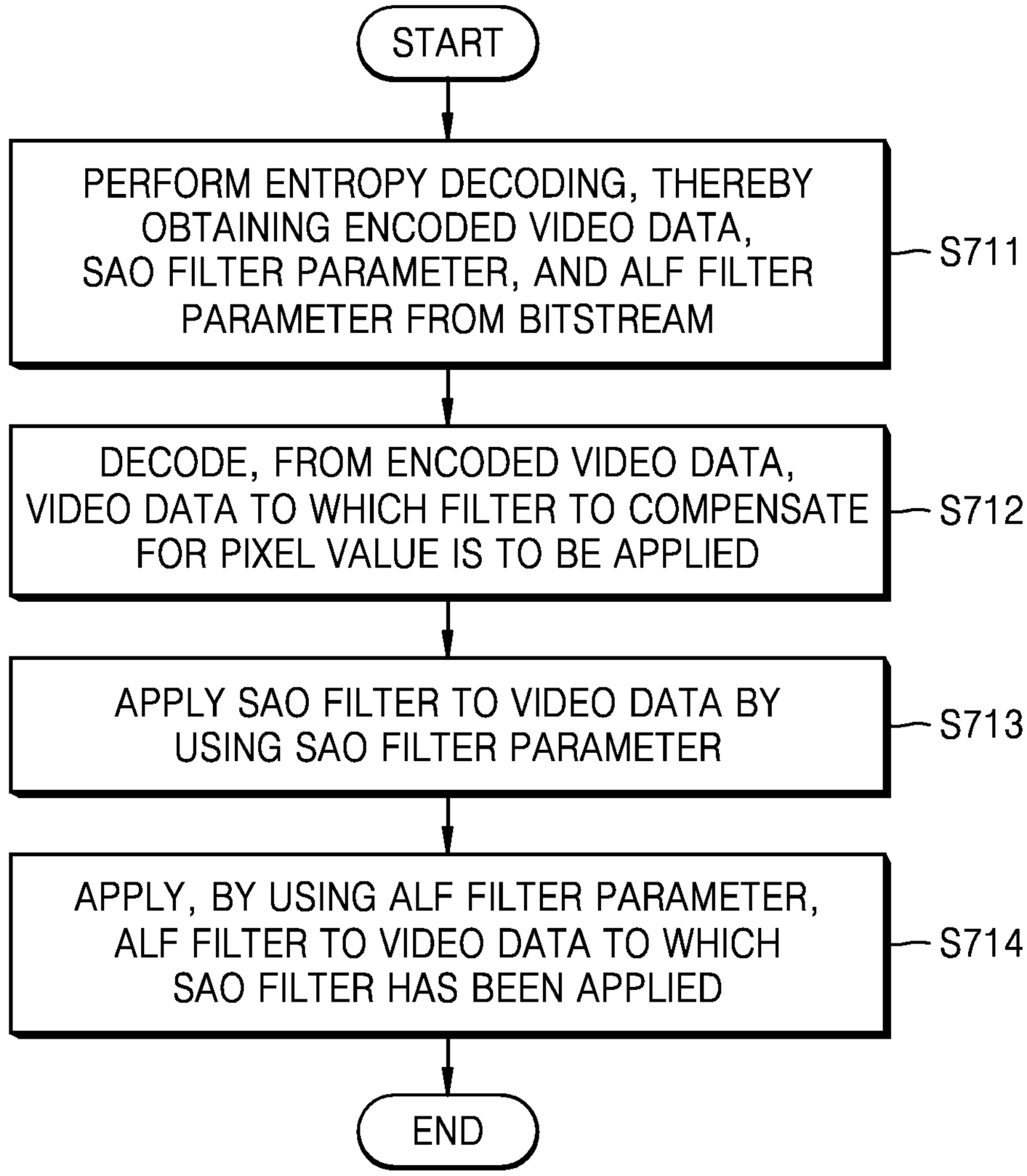

START
PERFORM ENTROPY DECODING, THEREBY OBTAINING ENCODED VIDEO DATA, SAO FILTER PARAMETER, AND ALF FILTER PARAMETER FROM BITSTREAM
S711
DECODE, FROM ENCODED VIDEO DATA, VIDEO DATA TO WHICH FILTER TO COMPENSATE FOR PIXEL VALUE IS TO BE APPLIED
S712
APPLY SAO FILTER TO VIDEO DATA BY USING SAO FILTER PARAMETER
S713
APPLY, BY USING ALF FILTER PARAMETER, ALF FILTER TO VIDEO DATA TO WHICH SAO FILTER HAS BEEN APPLIED
S714
END

FIG. 7C

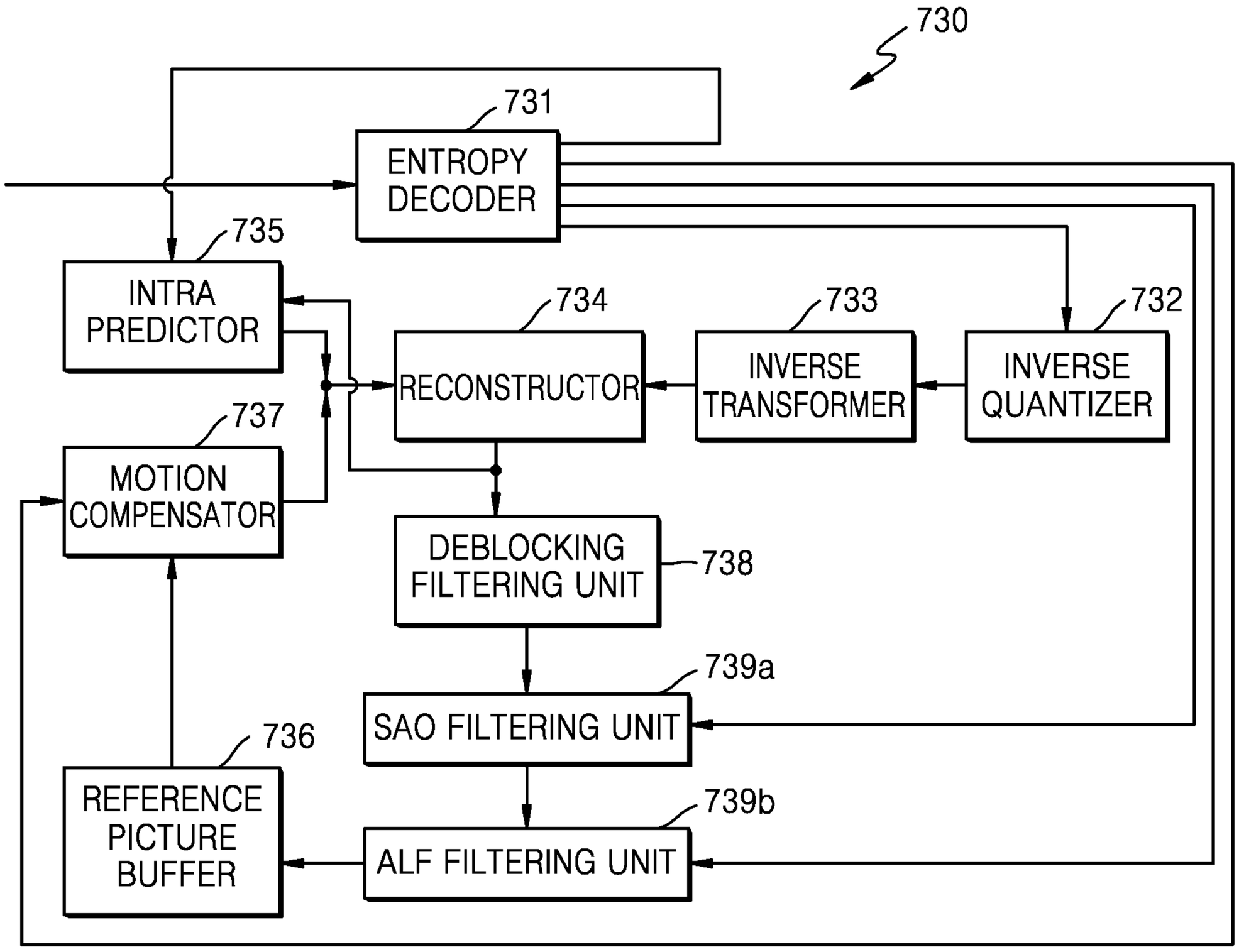

730
731
ENTROPY DECODER
735
INTRA PREDICTOR
734
RECONSTRUCTOR
733
INVERSE TRANSFORMER
732
INVERSE QUANTIZER
737
MOTION COMPENSATOR
DEBLOCKING FILTERING UNIT
738
739a
SAO FILTERING UNIT
736
REFERENCE PICTURE BUFFER
739b
ALF FILTERING UNIT

FIG. 7D

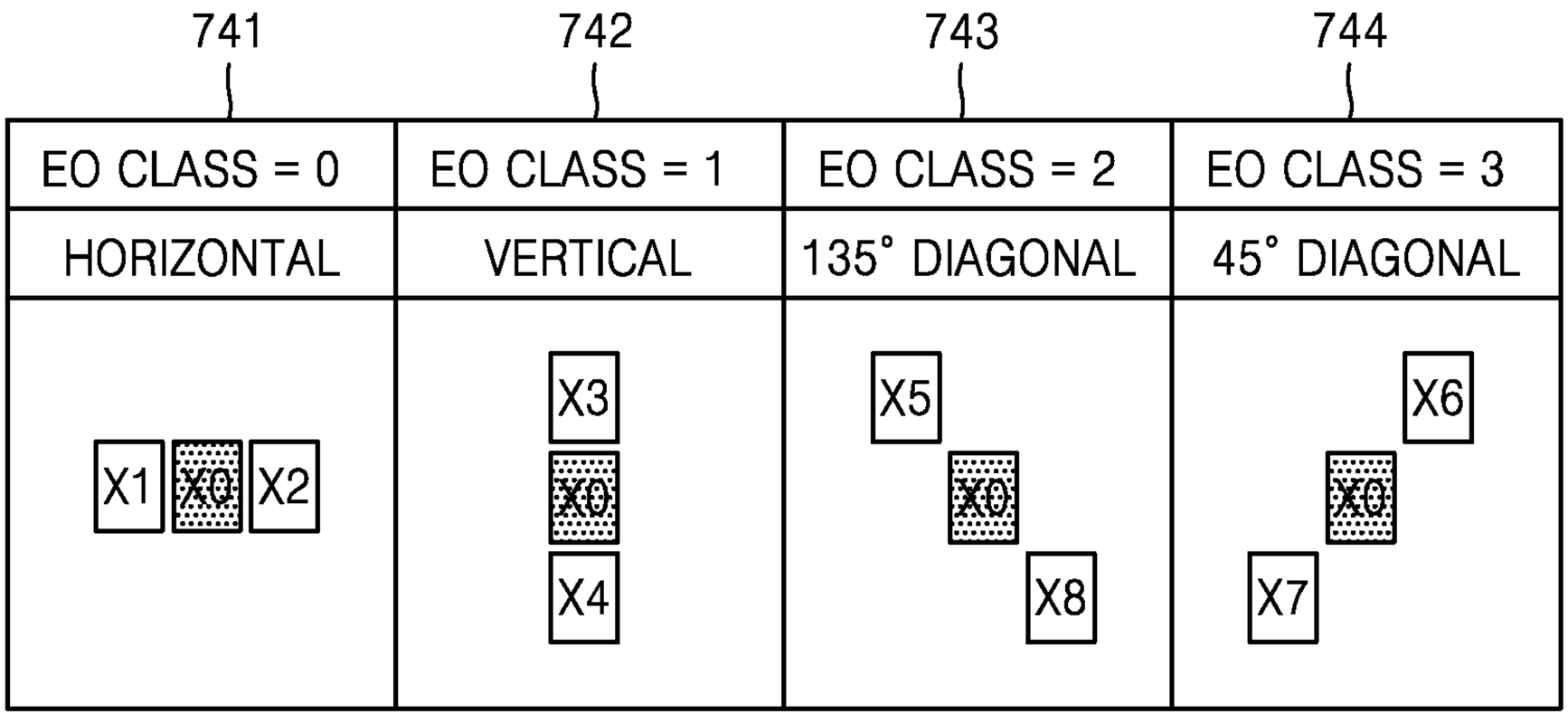

741
742
743
744
EO CLASS = 0
EO CLASS = 1
EO CLASS = 2
EO CLASS = 3
HORIZONTAL
VERTICAL
135° DIAGONAL
45° DIAGONAL
X1
X0
X2
X3
X0
X4
X5
X0
X8
X6
X0
X7

FIG. 7E

CATEGORY	CONDITION
1	Xc < Xa && Xc < Xb
2	(Xc < Xa && Xc == Xb)‖(Xc == Xa && Xc < Xb)
3	(Xc > Xa && Xc == Xb)‖(Xc == Xa && Xc > Xb)
4	Xc > Xa && Xc > Xb
0	WHEN CONDITIONS OF CATEGORIES 1, 2, 3, 4 ARE NOT SATISFIED

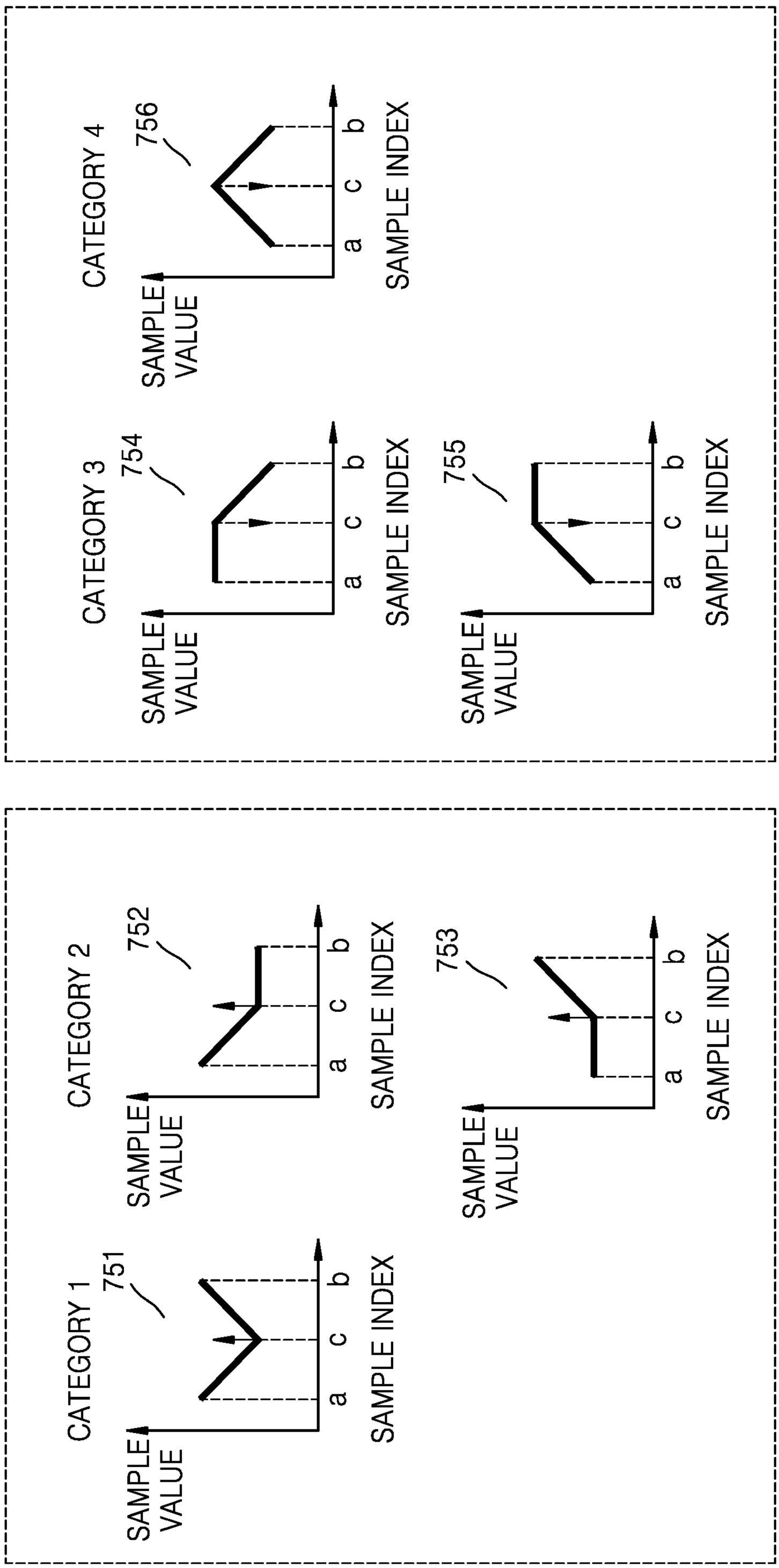

CATEGORY 4
756
SAMPLE VALUE
a c b
SAMPLE INDEX
CATEGORY 3
754
SAMPLE VALUE
a c b
SAMPLE INDEX
755
SAMPLE VALUE
a c b
SAMPLE INDEX
CATEGORY 2
752
SAMPLE VALUE
a c b
SAMPLE INDEX
753
SAMPLE VALUE
a c b
SAMPLE INDEX
CATEGORY 1
751
SAMPLE VALUE
a c b
SAMPLE INDEX

FIG. 7F

FIG. 7G

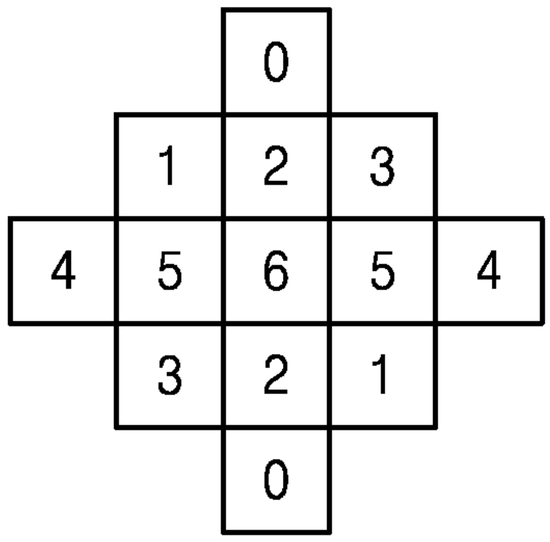


FIG. 8

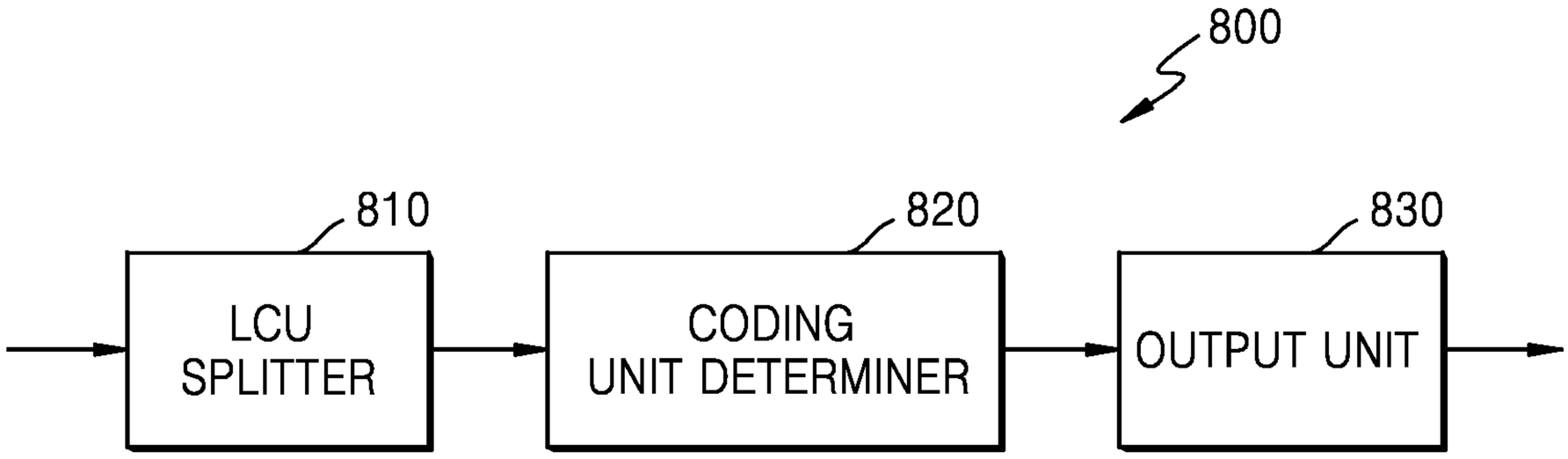

800
810
LCU SPLITTER
820
CODING UNIT DETERMINER
830
OUTPUT UNIT

FIG. 9

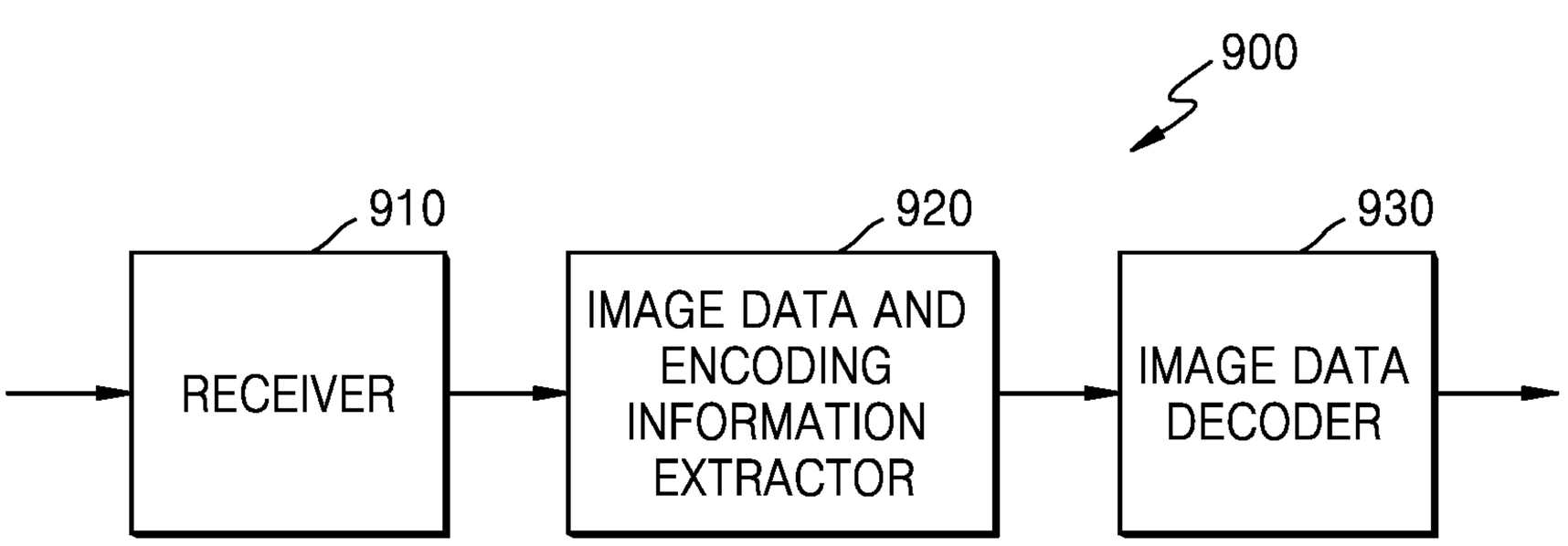

900
910
RECEIVER
920
IMAGE DATA AND ENCODING INFORMATION EXTRACTOR
930
IMAGE DATA DECODER

FIG. 10

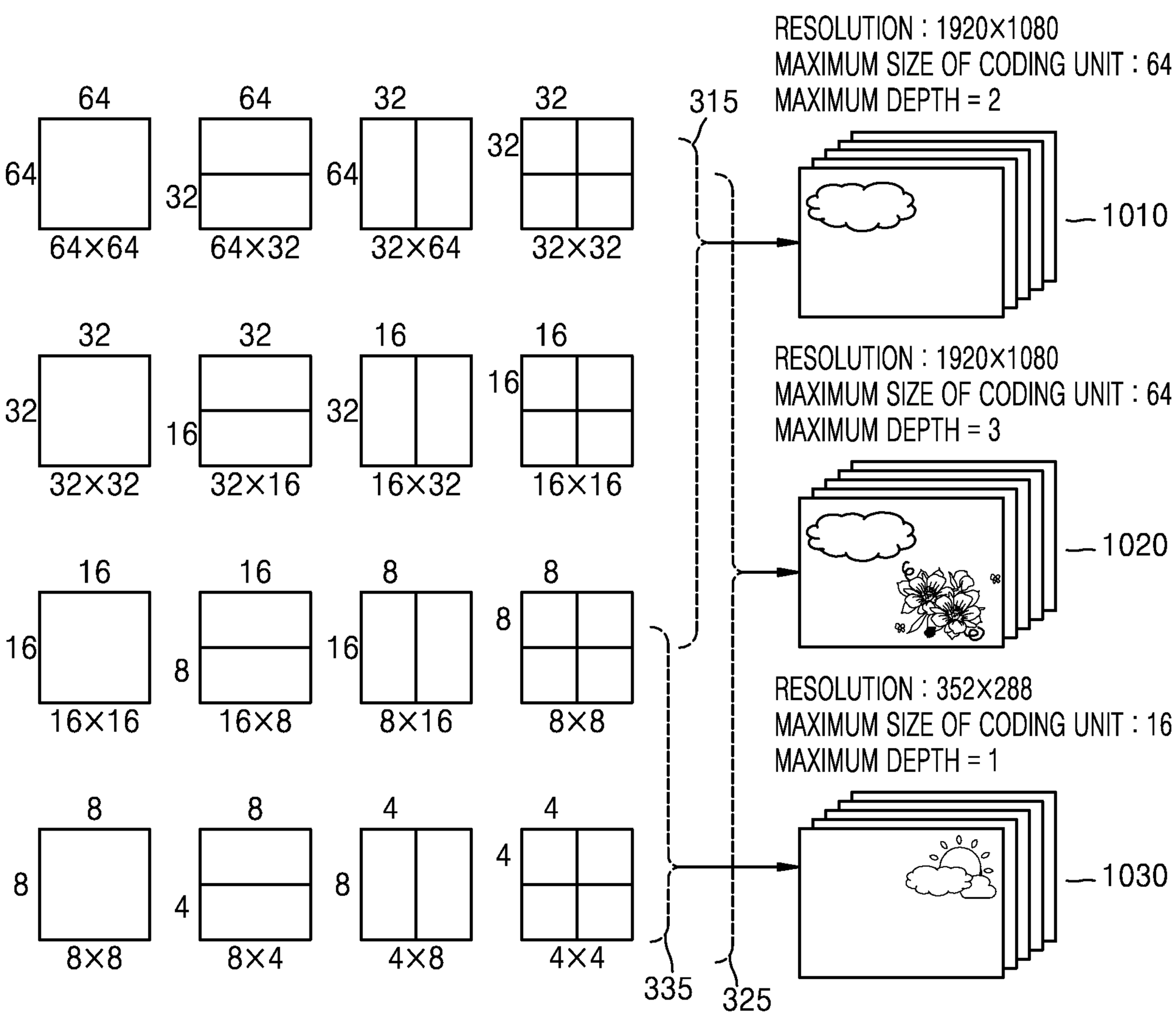

64
64
32
32
315
64
32
64
32
64×64
64×32
32×64
32×32
RESOLUTION : 1920×1080
MAXIMUM SIZE OF CODING UNIT : 64
MAXIMUM DEPTH = 2
1010
32
32
16
16
32
32
16
16
32×32
32×16
16×32
16×16
RESOLUTION : 1920×1080
MAXIMUM SIZE OF CODING UNIT : 64
MAXIMUM DEPTH = 3
1020
16
16
8
8
16
16
8
8
16×16
16×8
8×16
8×8
RESOLUTION : 352×288
MAXIMUM SIZE OF CODING UNIT : 16
MAXIMUM DEPTH = 1
8
8
4
4
8
8
4
4
8×8
8×4
4×8
4×4
1030
335
325

FIG. 11

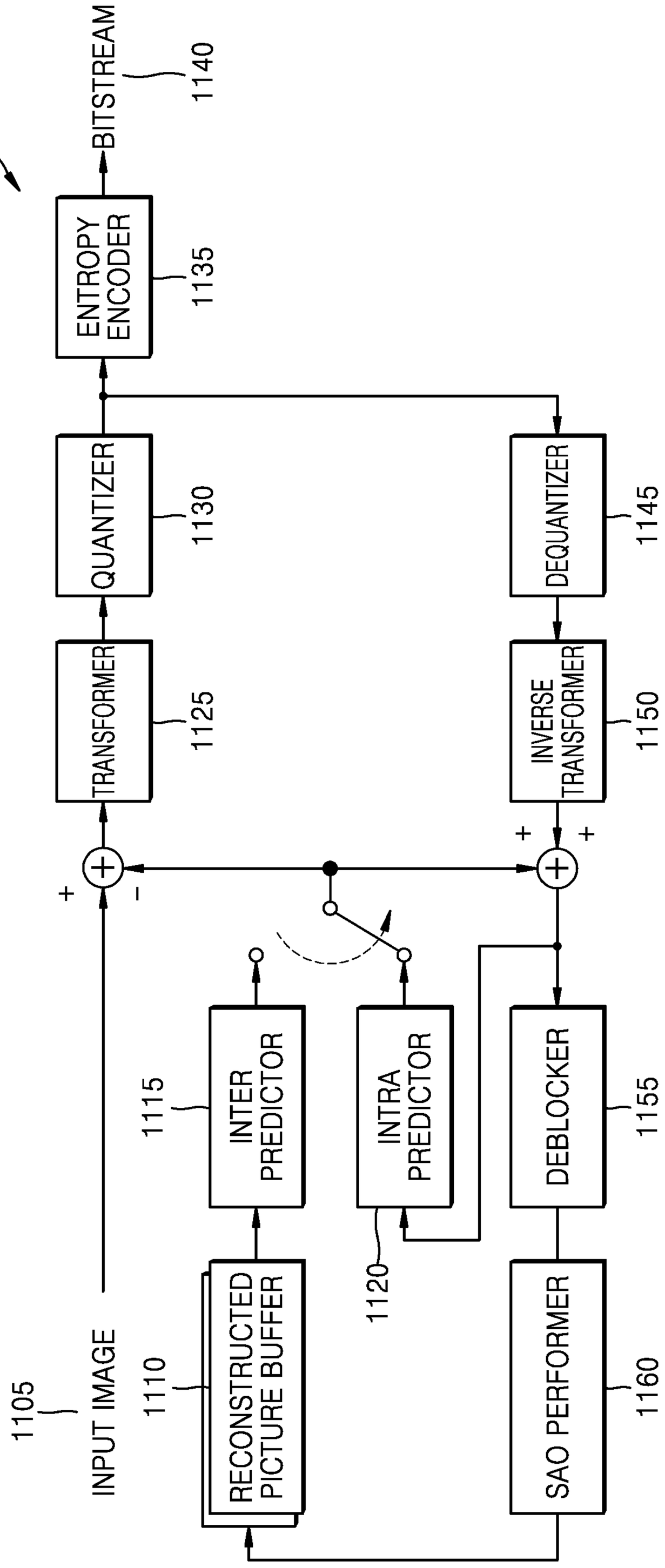

1100
BITSTREAM
1140
ENTROPY ENCODER
1135
QUANTIZER
1130
TRANSFORMER
1125
DEQUANTIZER
1145
INVERSE TRANSFORMER
1150
+
-
+
+
INTER PREDICTOR
1115
INTRA PREDICTOR
DEBLOCKER
1155
1120
RECONSTRUCTED PICTURE BUFFER
1110
SAO PERFORMER
1160
1105
INPUT IMAGE

FIG. 12

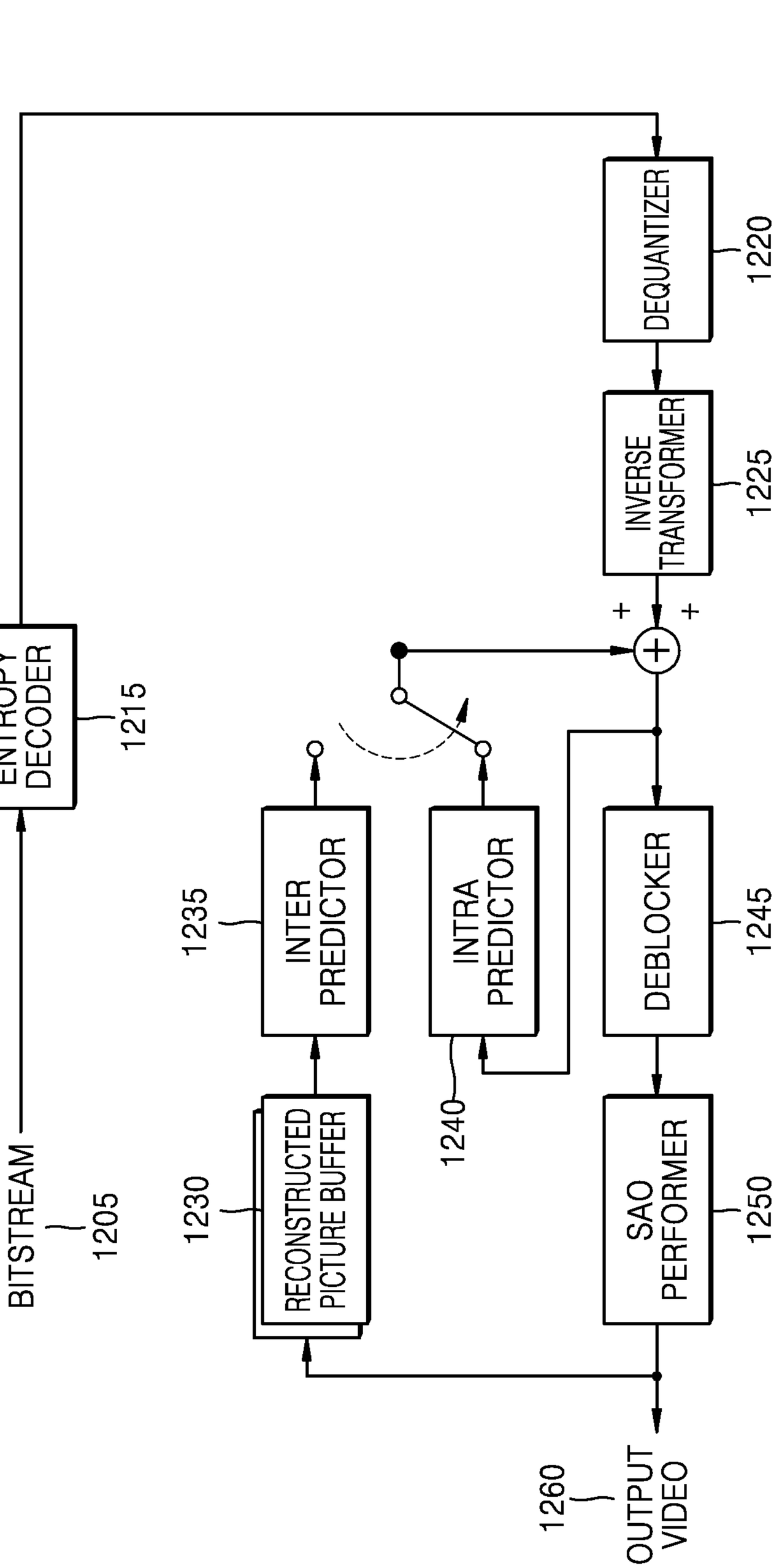

1200
DEQUANTIZER
1220
INVERSE TRANSFORMER
1225
+
+
ENTROPY DECODER
1215
BITSTREAM
1205
1235
INTER PREDICTOR
INTRA PREDICTOR
DEBLOCKER
1245
1230
RECONSTRUCTED PICTURE BUFFER
1240
SAO PERFORMER
1250
1260
OUTPUT VIDEO

FIG. 13

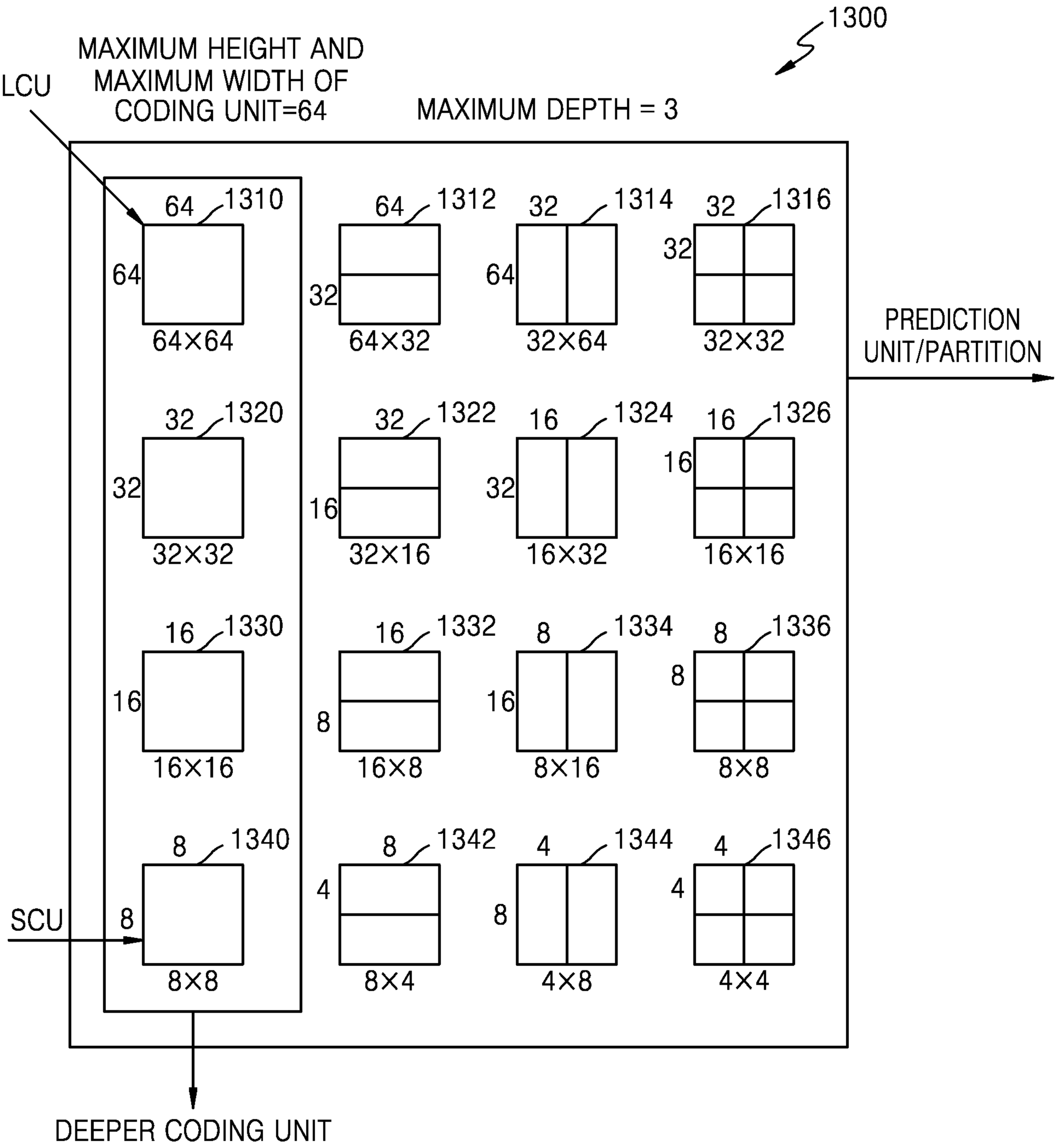

1300
LCU
MAXIMUM HEIGHT AND MAXIMUM WIDTH OF CODING UNIT=64
MAXIMUM DEPTH = 3
64
1310
64
64×64
64
1312
32
64×32
32
1314
64
32×64
32
1316
32
32×32
32
1320
32
32×32
32
1322
16
32×16
16
1324
32
16×32
16
1326
16
16×16
16
1330
16
16×16
16
1332
8
16×8
8
1334
16
8×16
8
1336
8
8×8
8
1340
8
8×8
8
1342
4
8×4
4
1344
8
4×8
4
1346
4
4×4
PREDICTION UNIT/PARTITION
SCU
DEEPER CODING UNIT

FIG. 14

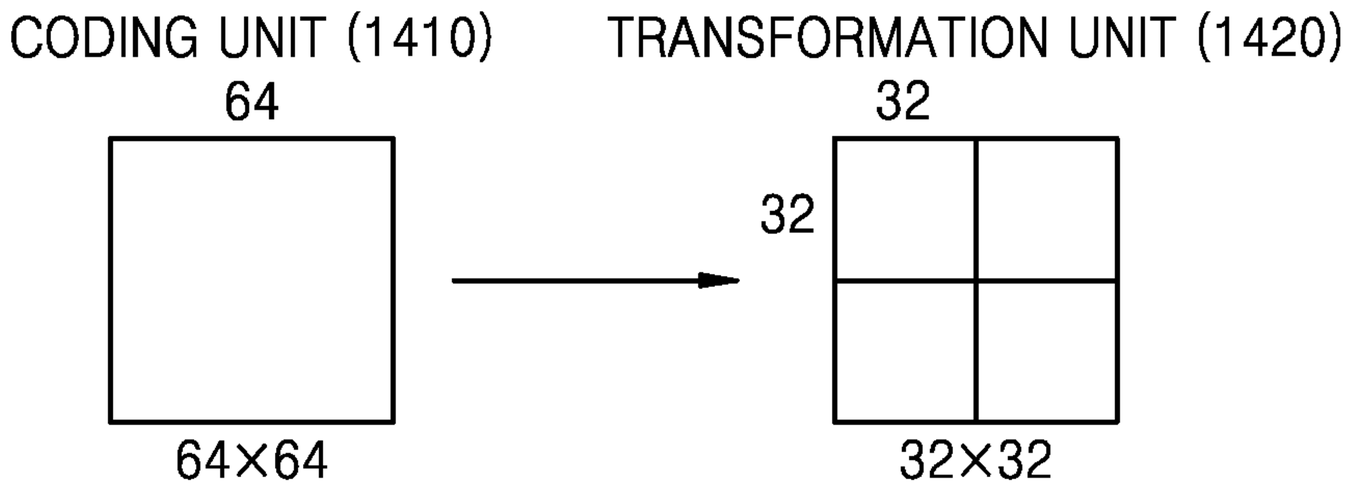
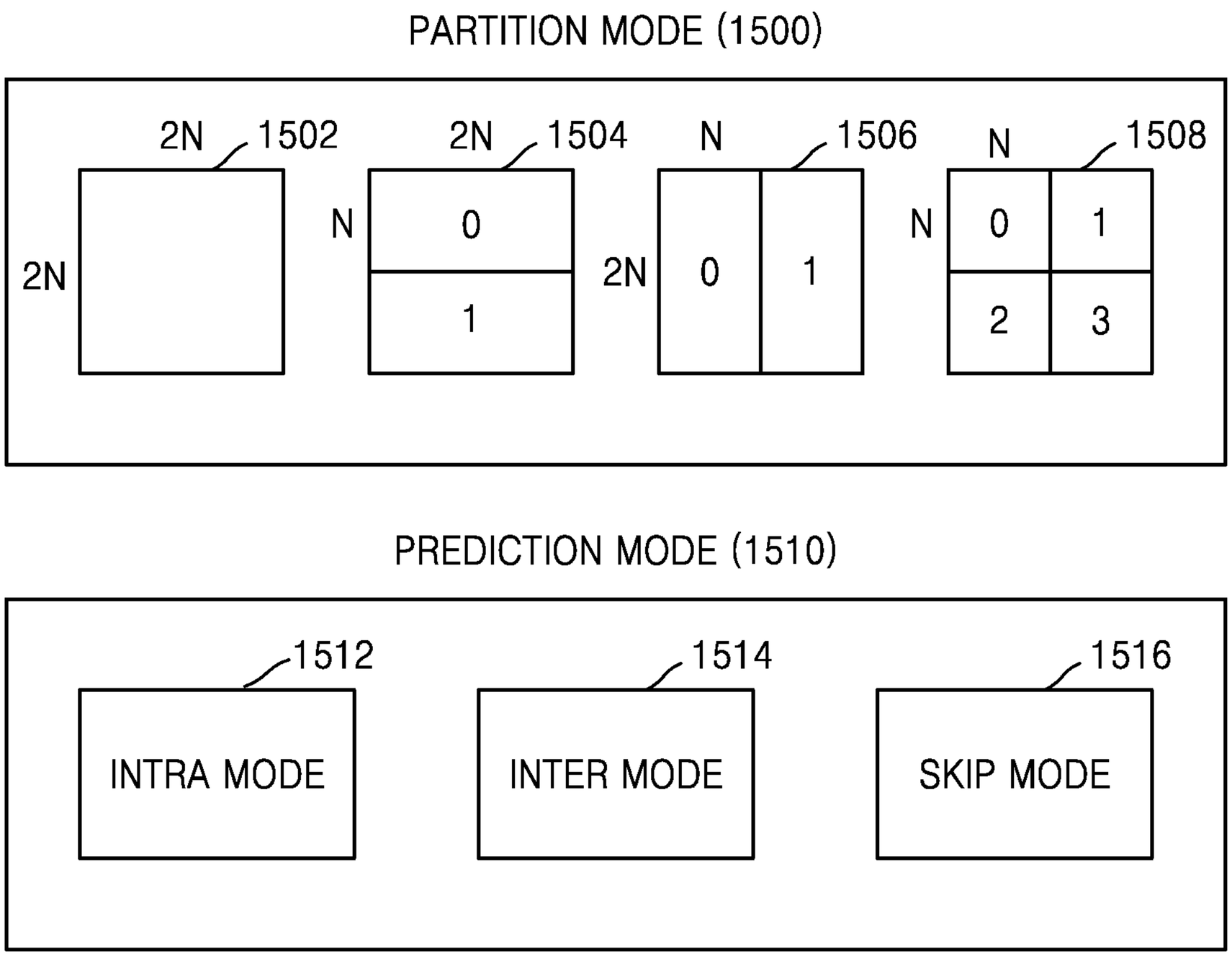

CODING UNIT (1410)
64
64×64
TRANSFORMATION UNIT (1420)
32
32
32×32

FIG. 15


PARTITION MODE (1500)
2N
1502
2N
1504
N
1506
N
1508
2N
N
0
1
2N
0
1
N
0
1
2
3
PREDICTION MODE (1510)
1512
INTRA MODE
1514
INTER MODE
1516
SKIP MODE
SIZE OF TRANSFORMATION UNIT (1520)
1522
1524
1526
1528
INTER

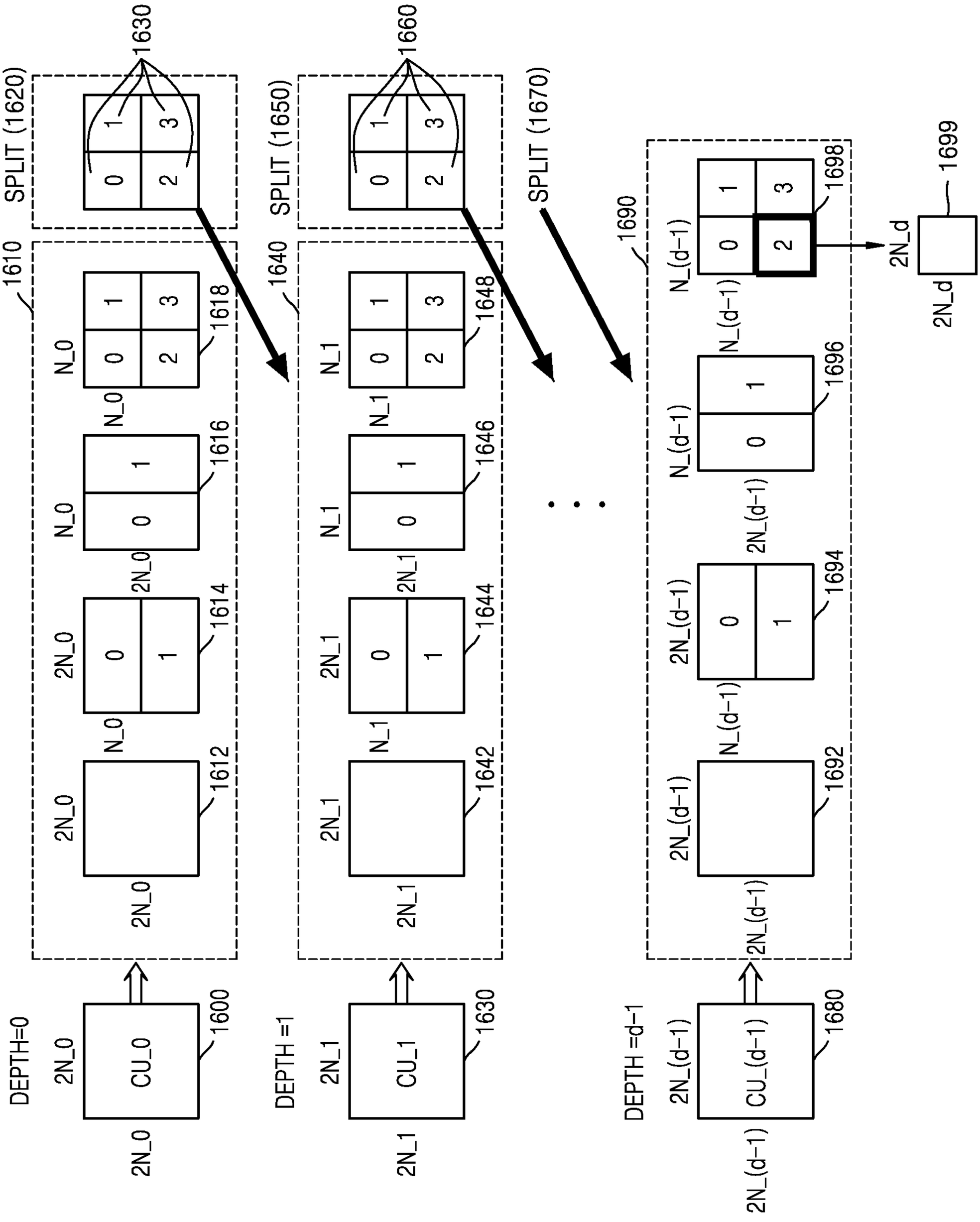

DEPTH=0
2N_0
CU_0
1600
2N_0
2N_0
1612
N_0
2N_0
2N_0
1614
2N_0
N_0
2N_0
1616
N_0
2N_0
2N_0
1618
N_0
SPLIT (1620)
1610
1630
DEPTH =1
2N_1
CU_1
1630
2N_1
2N_1
1642
N_1
2N_1
2N_1
1644
2N_1
N_1
2N_1
1646
N_1
2N_1
2N_1
1648
N_1
SPLIT (1650)
1640
1660
DEPTH =d-1
2N_(d-1)
CU_(d-1)
1680
2N_(d-1)
2N_(d-1)
1692
N_(d-1)
2N_(d-1)
2N_(d-1)
1694
2N_(d-1)
N_(d-1)
2N_(d-1)
1696
N_(d-1)
2N_(d-1)
2N_(d-1)
1698
N_(d-1)
SPLIT (1670)
1690
2N_d
2N_d
1699

FIG. 16

FIG. 17

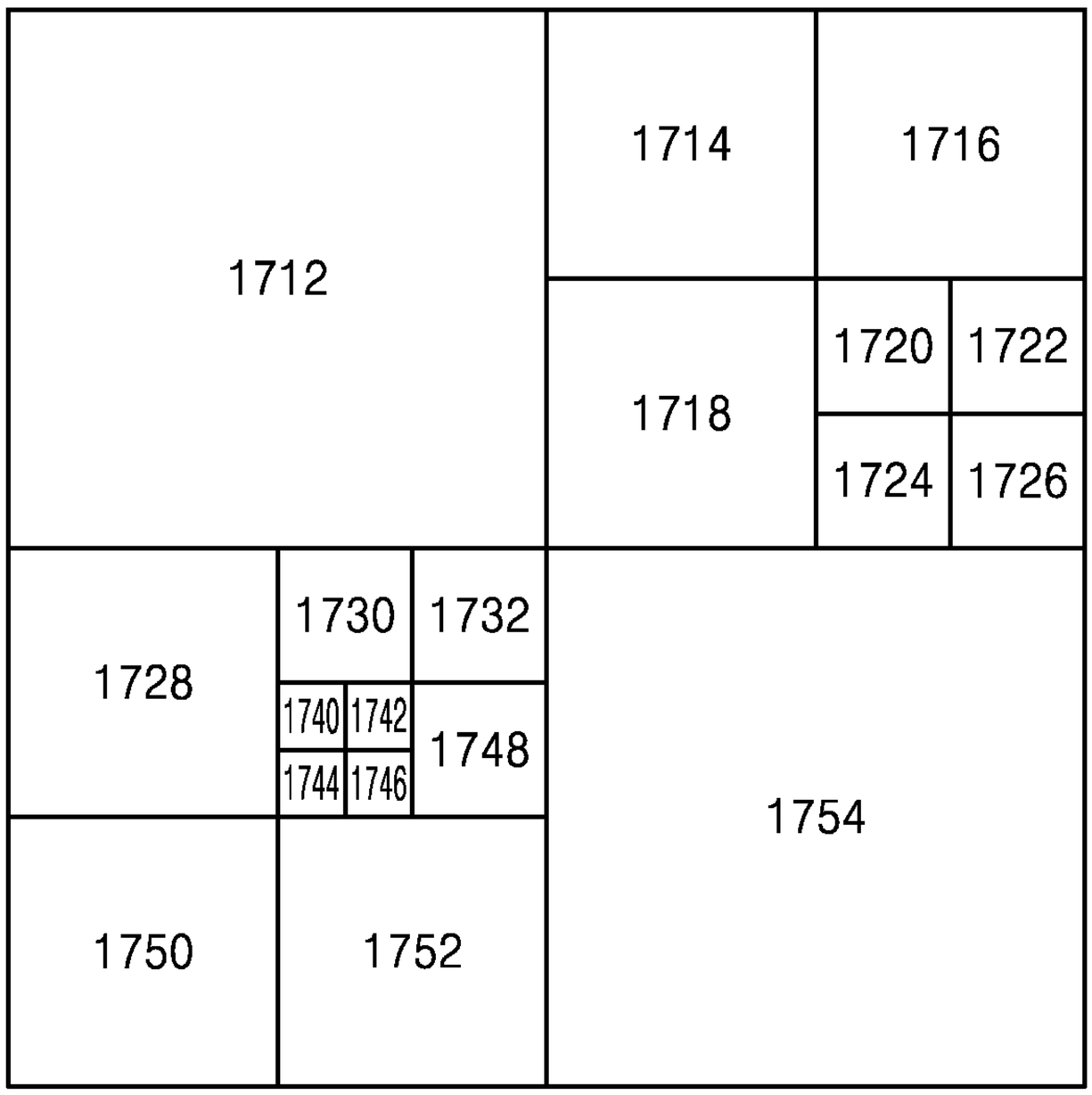

1712
1714
1716
1718
1720
1722
1724
1726
1728
1730
1732
1740
1742
1744
1746
1748
1750
1752
1754
CODING UNIT (1710)

FIG. 18

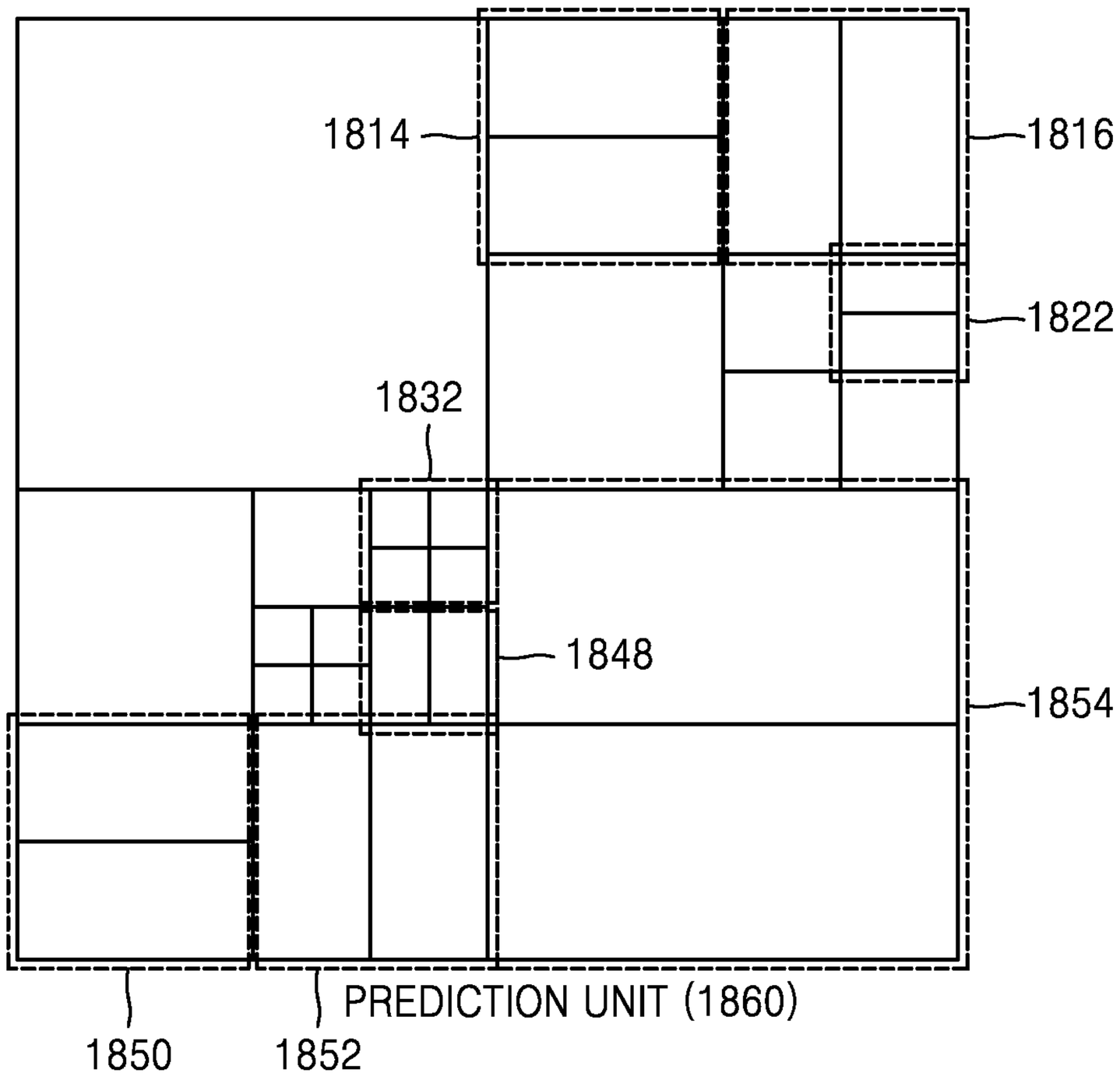

1814
1816
1822
1832
1848
1854
PREDICTION UNIT (1860)
1850
1852

FIG. 19

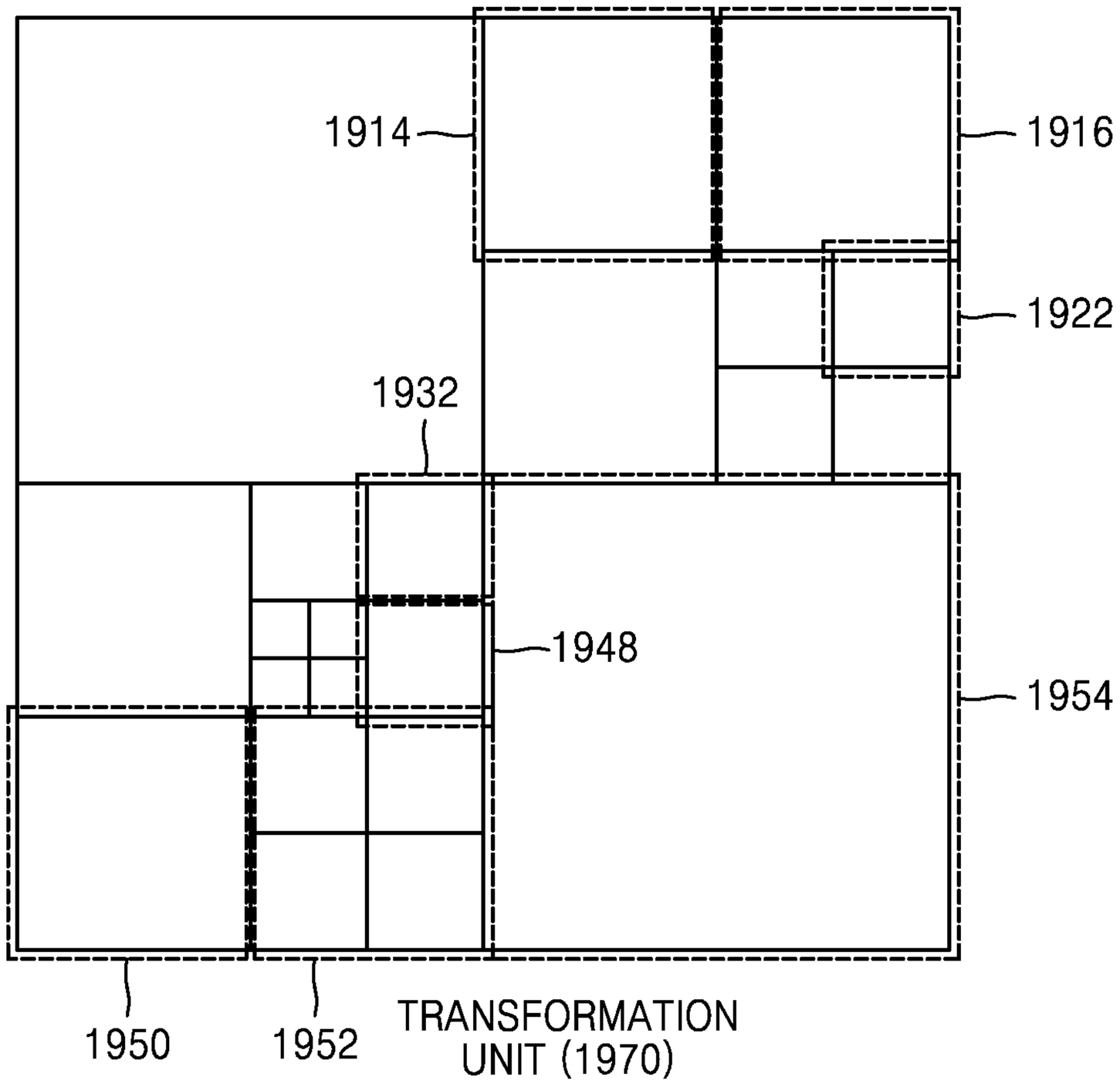

1914
1916
1922
1932
1948
1954
1950
1952
TRANSFORMATION UNIT (1970)

FIG. 20

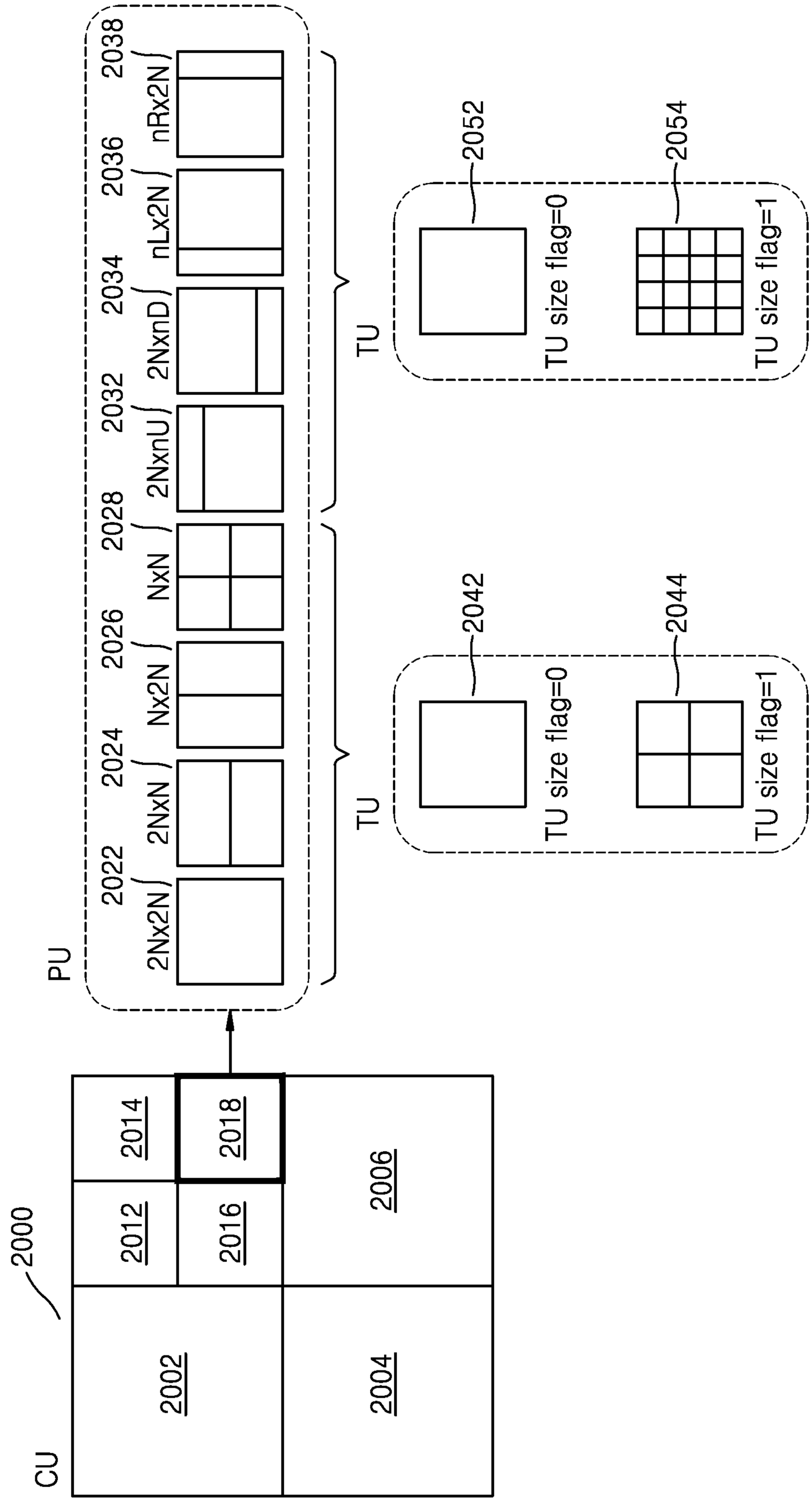

CU
2000
2002
2004
2006
2012
2014
2016
2018
PU
2022
2Nx2N
2024
2NxN
Nx2N
2026
2028
NxN
2032
2NxnU
2034
2NxnD
nLx2N
2036
nRx2N
2038
TU
2042
2044
TU size flag=0
TU size flag=1
2052
2054
TU
TU size flag=0
TU size flag=1

FIG. 21

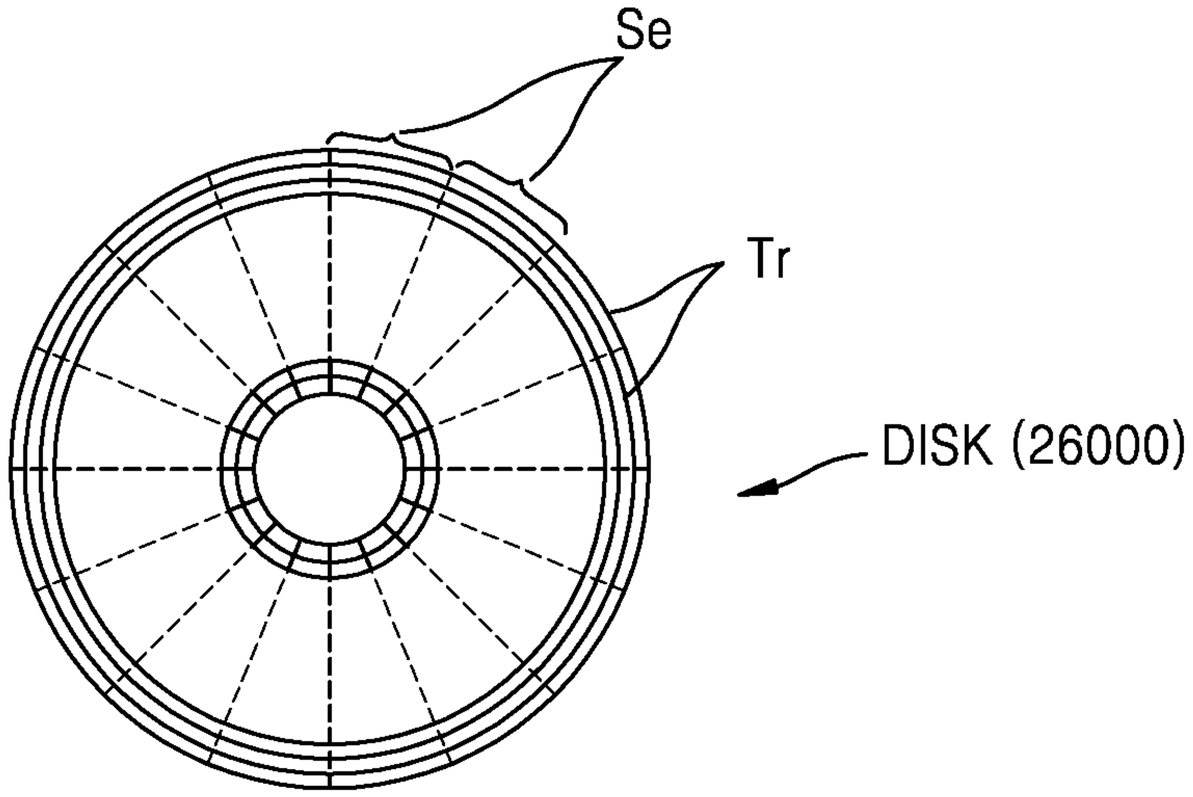


FIG. 22

FIG. 23

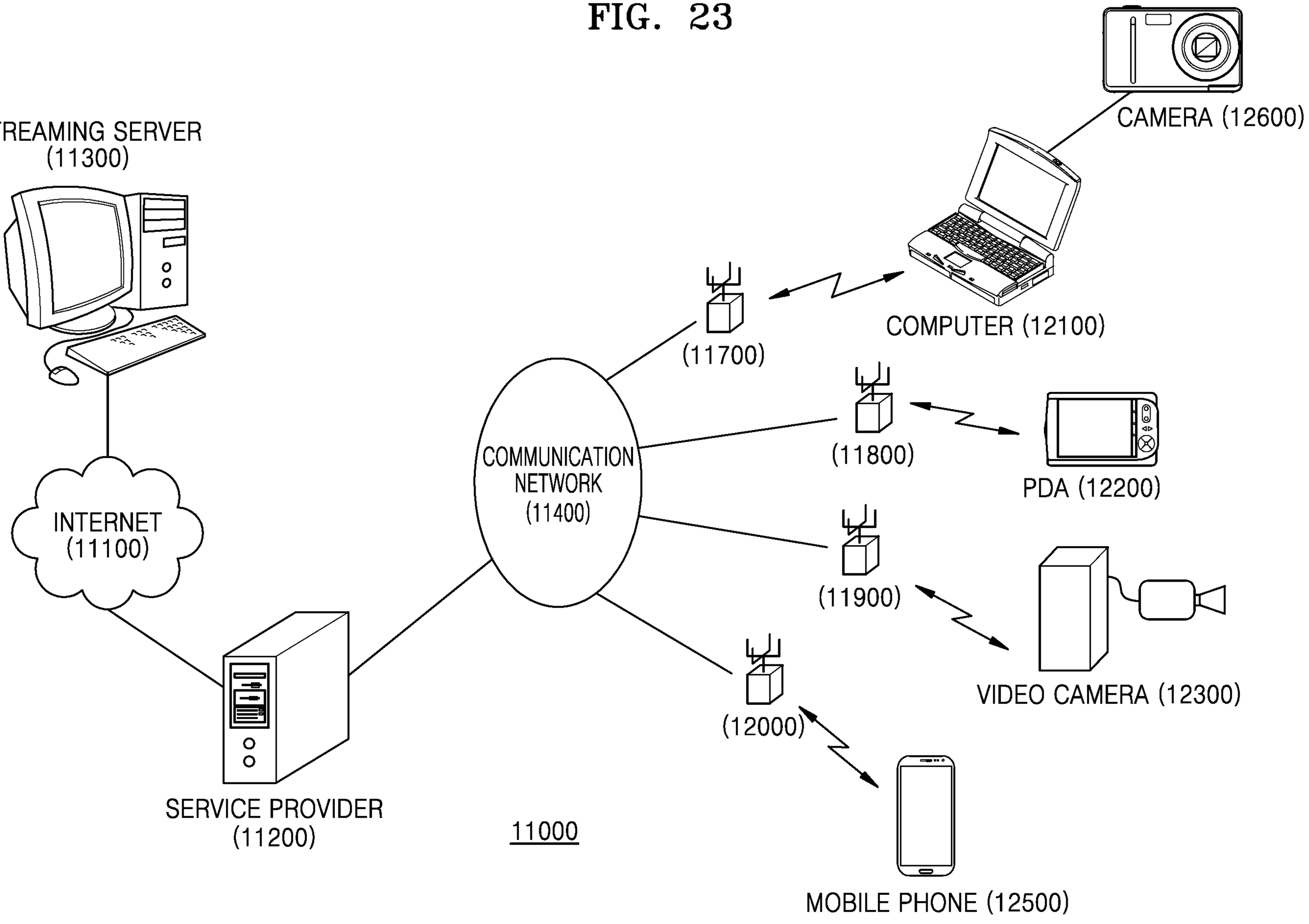

STREAMING SERVER
(11300)
INTERNET
(11100)
SERVICE PROVIDER
(11200)
COMMUNICATION
NETWORK
(11400)
(11700)
(11800)
(11900)
(12000)
CAMERA (12600)
COMPUTER (12100)
PDA (12200)
VIDEO CAMERA (12300)
MOBILE PHONE (12500)
11000

FIG. 24

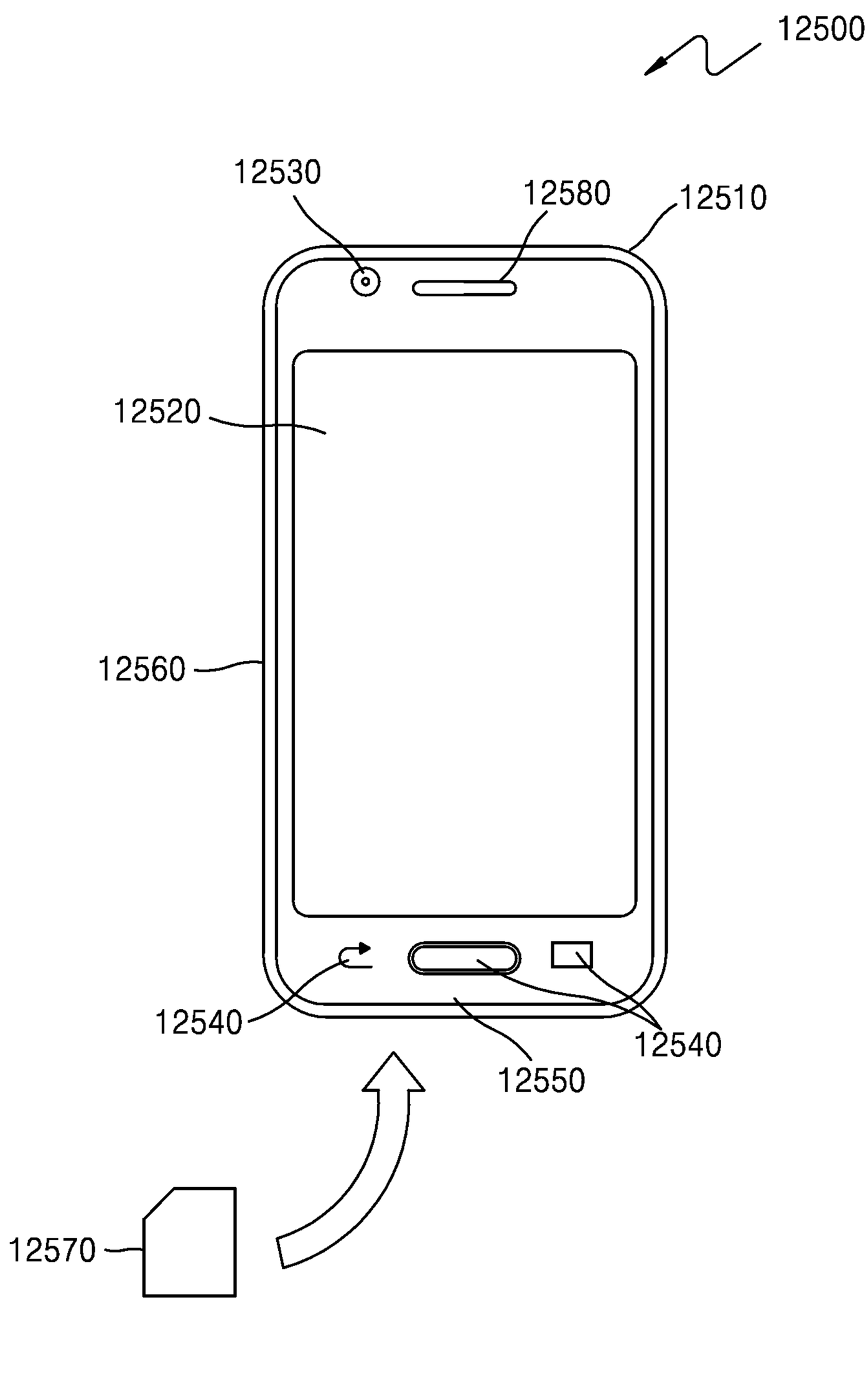

12500
12530
12580
12510
12520
12560
12540
12550
12540
12570

FIG. 25

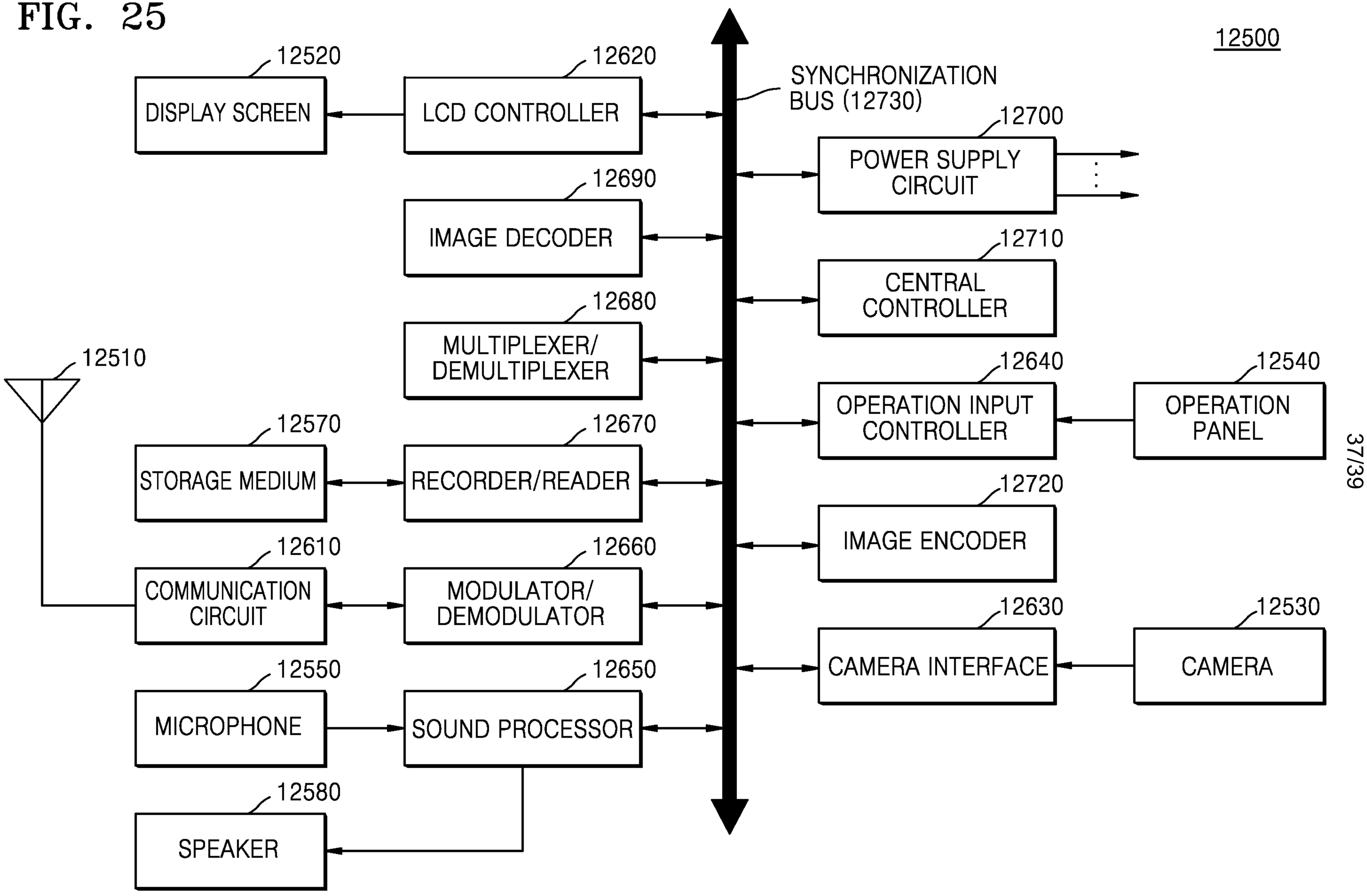

12500
12520
DISPLAY SCREEN
12620
LCD CONTROLLER
SYNCHRONIZATION BUS (12730)
12700
POWER SUPPLY CIRCUIT
12690
IMAGE DECODER
12710
CENTRAL CONTROLLER
12680
MULTIPLEXER/ DEMULTIPLEXER
12510
12640
OPERATION INPUT CONTROLLER
12540
OPERATION PANEL
12570
STORAGE MEDIUM
12670
RECORDER/READER
12720
IMAGE ENCODER
12610
COMMUNICATION CIRCUIT
12660
MODULATOR/ DEMODULATOR
12630
CAMERA INTERFACE
12530
CAMERA
12550
MICROPHONE
12650
SOUND PROCESSOR
12580
SPEAKER

FIG. 26

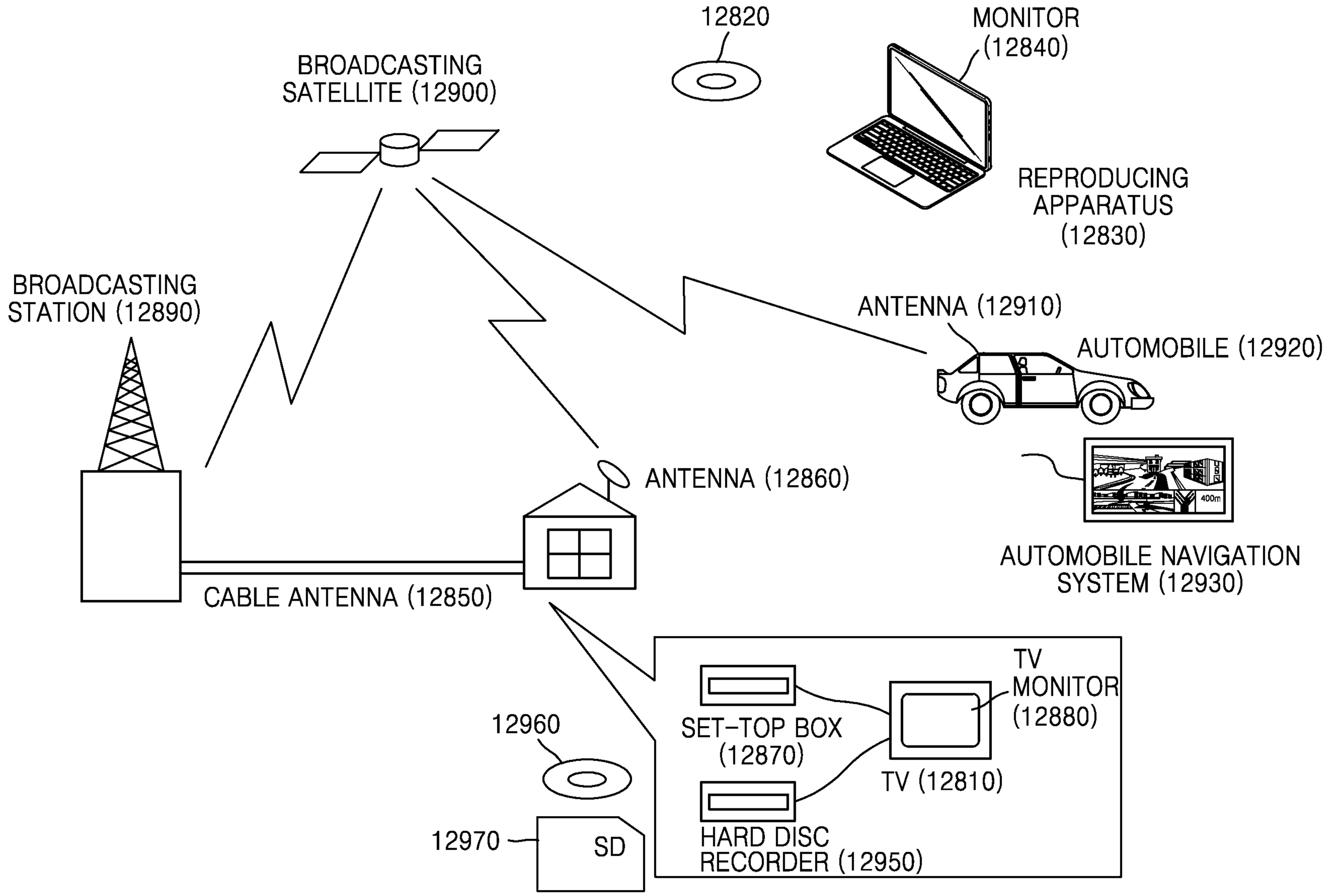
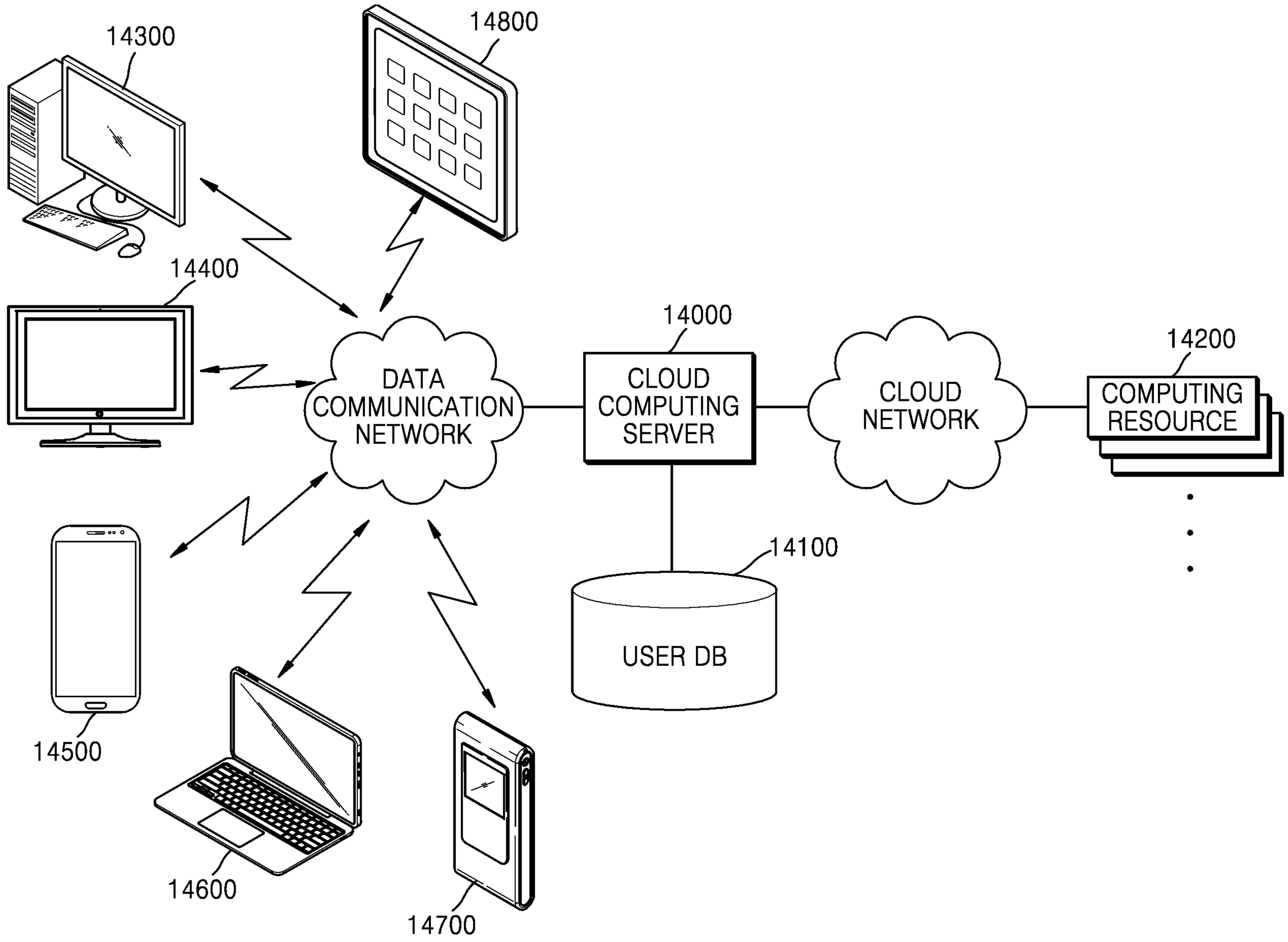

12820
MONITOR
(12840)
BROADCASTING
SATELLITE (12900)
REPRODUCING
APPARATUS
(12830)
BROADCASTING
STATION (12890)
ANTENNA (12910)
AUTOMOBILE (12920)
ANTENNA (12860)
400m
AUTOMOBILE NAVIGATION
SYSTEM (12930)
CABLE ANTENNA (12850)
TV
MONITOR
(12880)
SET-TOP BOX
(12870)
TV (12810)
12960
12970
SD
HARD DISC
RECORDER (12950)

FIG. 27


14300
14800
14400
14000
14200
DATA COMMUNICATION NETWORK
CLOUD COMPUTING SERVER
CLOUD NETWORK
COMPUTING RESOURCE
14100
USER DB
14500
14600
14700